

Overlapping Proprietary Rights in University-Generated Research Products: The Case of Computer Programs

by J.H. Reichman*

INTRODUCTION

Since 1964, when the United States Copyright Office tentatively agreed to register computer programs as literary works under the Copyright Act of 1909,¹ pressures to protect important new technologies from duplication by free-riding competitors have increasingly broken down the conceptual barriers that heretofore separated artistic from industrial property laws. At times, these pressures have led to legislative enactment of *sui generis* laws² that deviate from the classical copyright and patent paradigms.³ More often, the legislative and judicial authori-

* Professor of Law, Vanderbilt University, B.A., 1955, University of Chicago, J.D., 1979, Yale Law School.

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1. See George D. Cary, *Copyright Registration and Computer Programs*, 11 BULL. COPYRIGHT SOC'Y 362 (1964).

2. See, e.g., Plant Variety Protection Act, Pub. L. No. 91-577, 84 Stat. 1542 (1970), amended by Pub. L. No. 96-574 (1970), § 1, 94 Stat. 3350 (1980) (codified as amended at 7 U.S.C. §§ 2321-2583 (1988)) (providing patent-like protection for novel sexually-propagated plant varieties without requiring nonobviousness); *infra* notes 299-344 and accompanying text (discussing copyright-like protection of integrated circuit designs under Semiconductor Chip Protection Act of 1984); *infra* notes 345-91 and accompanying text (discussing copyright-like protection of both functional and nonfunctional industrial designs under United Kingdom's Copyright, Designs and Patents Act of 1988).

3. See, e.g., J.H. Reichman, *Computer Programs as Applied Scientific Know-How: Implications of Copyright Protection for Commercialized University Research*, 42 VAND. L. REV. 639, 648-67 (1989) [hereinafter *Programs as Know-How*]; Jerome H. Reichman, *Legal Hybrids Between the Patent and Copyright Paradigms*, in INFORMATION LAW TOWARDS THE

ties in industrialized countries have opted to disaggregate new products of incremental innovation into their component parts and to cram these parts into preexisting legal paradigms devised for patents, copyrights, industrial designs, trademarks, trade secrets and unfair competition.⁴ One result of such tendencies is that each of these often trivial components becomes entangled in an endless web of ownership and scope-of-protection issues logically spawned by each of the competing legal subcultures.⁵ The transaction costs of resolving these issues increasingly shift resources from innovation to litigation, which undermines the purposes for which legal incentives are initially provided. Meanwhile, continuing efforts to adapt existing legal paradigms to new technologies diverts attention from the fundamental need to devise a suitable form of protection for applied scientific know-how in general.⁶

This article briefly reviews the macro-legal developments that render the ascription of proprietary rights to creators of important new technologies an increasingly delicate task. It then examines a set of typical micro-legal problems, with particular reference to the laws of the United States and the United Kingdom, using the example of computer programs developed in a university environment to illustrate the overlapping and contradictory ownership rules currently applied. The article concludes with general observations about the growing destabilization of classical patent and copyright systems and the need to remedy the underlying causes by moving world intellectual property law in new directions.

21ST CENTURY 325, 335-49 (Willem F. Korthals Altes et al. eds., 1992) (conference proceedings containing excerpts from a work in progress) [hereinafter Reichman, *Legal Hybrids*].

4. See, e.g., John H. Barton, *Adapting the Intellectual Property System to New Technologies*, paper presented to the National Research Council's Conference on Intellectual Property Rights in the Global Arena of Science and Technology, Washington, D.C., January 8-9, 1992; Randall Davis, *Intellectual Property and Software: The Assumptions Are Broken*, in WIPO WORLDWIDE SYMPOSIUM ON THE INTELLECTUAL PROPERTY ASPECTS OF ARTIFICIAL INTELLIGENCE 101-120 (1991) [hereinafter WIPO SYMPOSIUM]; Pamela Samuelson, Benson Revisited: *The Case Against Patent Protection for Algorithms and Other Computer Program-Related Inventions*, 39 EMORY L.J. 1025, 1092-1153 (1990) [hereinafter Samuelson, Benson Revisited]; Pamela Samuelson, *CONTU Revisited: The Case Against Copyright Protection for Computer Programs in Machine-Readable Form*, 1984 DUKE L.J. 663, 705-54 [hereinafter Samuelson, *CONTU Revisited*]; David Ladd, *To Cope with the World Upheaval in Copyright*, 19 COPYRIGHT 289 (1983). See also *infra* text accompanying notes 392-406.

5. See, e.g., J.H. Reichman, *Electronic Information Tools—The Outer Edge of World Intellectual Property Law*, 17 U. DAYTON L. REV. 797, 801-06, 813-20 (1992) [hereinafter Reichman, *Electronic Information Tools*]; *infra* text accompanying notes 400-04.

6. See *infra* text accompanying notes 404-06. See also Wendy J. Gordon, *On Owning Information: Intellectual Property and the Restitutionary Impulse*, 78 VA. L. REV. 149, 221-73 (1992) (proposing minimalist doctrine of misappropriation to protect investment in generating information-based products).

I. PROPRIETARY RIGHTS IN THE NEW LANDSCAPE OF INTELLECTUAL PROPERTY LAW

The international intellectual property system has developed few minimum standards for the ascription of proprietary rights as such; accordingly, that system depends on the vagaries of local law.⁷ For example, the domestic patent systems vary with respect to the determination of who may claim an invention,⁸ to the treatment of employee inventors,⁹ and to the treatment of government-owned inventions.¹⁰

7. The Berne Convention for the Protection of Literary and Artistic Works, Sept. 9, 1886, completed at Paris, May 4, 1896; revised in 1908, 1914, 1928, 1948, 1967 and most recently in Paris on July 24, 1971, S. TREATY DOC. NO. 27, 99th Cong., 2nd Sess. 37 (1986), 3 COPYRIGHT LAWS AND TREATIES OF THE WORLD (BNA), Multilateral Conventions, Berne Copyright Union: Item H-1, at 1 [hereinafter Berne Convention], art. 1 established "a Union for the protection of the rights of authors in their literary and artistic works." There is, however, no international minimum standard defining the concept of "author" under the Berne Convention. See, e.g., WIPO, GUIDE TO THE BERNE CONVENTION FOR THE PROTECTION OF LITERARY AND ARTISTIC WORKS (PARIS ACT, 1971) 11 (1978) [hereinafter WIPO GUIDE]; Adolph Dietz, *The Concept of Author Under the Berne Convention*, 155 R.I.D.A. (REVUE INTERNATIONALE DU DROIT D'AUTEUR) 2, 2-10 (1993); *infra* notes 11-13 and accompanying text. Whether an implicit standard of authorship requiring human intellectual creation can be derived from the convention remains a controversial issue. See, e.g., Sam Ricketson, *People or Machines: The Berne Convention and the Changing Concept of Authorship*, 16 COLUM.-VLA J.L. & ARTS 1, 8-12, 28 (1991).

Similarly, the Paris Convention for the Protection of Industrial Property, Mar. 20, 1883, as last revised at Stockholm, July 14, 1967, 21 U.S.T. 1583, T.I.A.S. No. 6923, 828 U.N.T.S. 305 [hereinafter Paris Convention], art. 4ter declares that the "inventor shall have the right to be mentioned as such in the patent." The Paris Convention, however, nowhere addresses the concept of "inventor," which local law then defines. See, e.g., G.H.C. BODENHAUSEN, GUIDE TO THE APPLICATION OF THE PARIS CONVENTION FOR THE PROTECTION OF INDUSTRIAL PROPERTY AS REVISED AT STOCKHOLM IN 1967 64 (1968); Jan Jończyk, *Employee Inventions*, 20 I.I.C. (INT'L. REV. OF INDUS. PROP. & COPYRIGHT L.) 847, 872 (1989) (stressing that national laws governing employee inventions remain too varied and undeveloped to support the institution of international standards).

8. While United States patent law recognizes the first to invent as the true inventor even for purposes of filing the patent application, 35 U.S.C. § 111 (1988), most other countries confer a patent on the first party to file the application or on the first to validly claim priority for an application covering the same invention. Under a first-to-file system, the applicant is deemed to be the true inventor or successor in title to the inventor, unless this statutory presumption is rebutted by a timely showing that the invention was unlawfully appropriated from the true inventor. See, e.g., 1 STEPHEN P. LADAS, PATENTS, TRADEMARKS, AND RELATED RIGHTS—NATIONAL AND INTERNATIONAL PROTECTION 321-24 (1975). The European Patent Convention of Munich, 1973, 13 ILM 270, art. 60, follows a modified version of the first-to-file system. See PAUL MATHÉLY, LE DROIT EUROPÉEN DES BREVETS D'INVENTION 153, 155-77 (1978). This topic lies beyond the scope of the present article.

9. Historically, "one of the most controversial and complex questions concern[s] the respective rights of employers and employees to the inventions made by the latter." 1 LADAS, *supra* note 8, at 324. Ladas identified three recurrent classes of cases, viz: 1) "service inventions," i.e., inventions arising from research or inventive activity that is the employee's primary task; 2) "dependent inventions," i.e., inventions not made pursuant to

The domestic copyright systems vary with respect to the requirements of "authorship,"¹¹ to the treatment of employee-authors in general,¹² and to the extent they attribute authorship in certain classes of works to persons other than the actual intellectual creators.¹³ Although these

an employment contract but arising within the employer's field of endeavor and developed with the use of his facilities, equipment or resources; and 3) "free inventions" made by the employee outside the scope of his employment and without the employer's assistance. See *id.* at 324-25.

Inventions falling within the third category belong to employees. *Id.* at 325. As regards the first and second categories, one question is whether the invention vests initially in the employer or employee and a second question concerns the rights of the party in whom the invention did not vest initially. A third question concerns the extent to which relations between employer and employee are subject to state regulation rather than freedom of contract. See *id.* at 325-29.

By and large, the civil-law countries have developed special legislation that enables employers to claim and exploit employee inventions on condition that employees receive reasonable compensation. See *id.* at 327-32; Jończyk, *supra* note 7. The European Patent Convention, *supra* note 8, art. 60, leaves ownership of employee inventions to be determined by the law of the state in which the employee is mainly employed. The present article does not analyze the civil-law approach and focuses primarily on employee-inventions under Anglo-American law, which relies on common-law principles applicable to contracts and employment relations in general. See 1 LADAS, *supra* note 8, at 326-27; *infra* text accompanying notes 67-69.

10. Special rules often apply to inventions made by government employees; such inventions may or may not become available for private exploitation under licenses that confer exclusive rights. See 1 LADAS, *supra* note 8, at 332-35. In the United States, for example, amendments to the patent law in 1980 authorized universities to own patents arising from research projects that the government had funded in whole or in part. See 35 U.S.C. §§ 200-204 (1988); David E. Korn, *Patent and Trade Secret Protection in University-Industry Research Relationships in Biotechnology*, 24 HARV. J. ON LEGIS. 191, 204 (1987) (questioning this policy when the research product is licensed exclusively to a private firm).

11. In general, the civil-law countries defined an author as one who made an "intellectual creation," while the common-law countries placed more emphasis on the degree of labor and skill involved, "a criterion . . . more appropriate in the context of a regime of unfair competition." SAM RICKETSON, *THE BERNE CONVENTION FOR THE PROTECTION OF LITERARY AND ARTISTIC WORKS: 1886-1986*, at 158 (1987). For the recent tendency of American and European copyright laws to converge in a common requirement of creative authorship, see *infra* notes 98-103 and accompanying text.

12. Traditionally, countries following the French copyright tradition recognize only natural persons as authors and do not allow corporate entities to be the first owners of copyright. In contrast, Anglo-American law recognizes corporate authorship with regard to works made for hire and in certain other instances. See, e.g., RICKETSON, *supra* note 11, at 158-59, 903; Paul E. Geller, *International Copyright: an Introduction*, 1 INTERNATIONAL COPYRIGHT LAW AND PRACTICE § 2[3][b] (P.E. Geller ed. 1990); *infra* text accompanying notes 119-25.

13. Even in countries that normally define "author" in terms of natural persons, there is a growing tendency to derogate from this principle with respect to certain classes of works. See, e.g., RICKETSON, *supra* note 11, at 902-03 (observing that "if someone else is deemed to be the 'author' of his work, the true author is, in effect, disenfranchised and deprived potentially of his moral rights as well"). Historically, this practice—known as "deemed authorship"—was often applied to cinematographic works because of the difficulties in identifying particular individuals as natural "authors" of the final production.

national differences greatly complicate international transactions in intellectual property law, a constant need to evaluate both foreign and domestic notions of authorship and inventorship in the application of international private law¹⁴ appears to have exerted some harmonizing influence on the laws of the industrialized countries, especially those of Continental Europe.¹⁵

In retrospect, the basic conceptual distinction between industrial and artistic property that underlies the Paris and Berne Conventions¹⁶ has also attenuated the effects of variations among the domestic laws governing ownership of intellectual property rights. Historically, this dichotomy presupposed a high degree of consensus concerning the basic subject matters of protection, namely, literary or artistic works and industrial inventions.¹⁷ Because the domestic copyright and patent

Although the specific rules vary from country to country, the legal author of a cinematographic work will usually be the person (such as the producer) or the entity in whose name the work was disclosed to the public. The Berne Convention authorizes this result. See Berne Convention, *supra* note 7, art. 14bis; Ricketson, *supra* note 7, at 14-17 (arguing that the special treatment of cinematographic works "serves to underscore the general principle that authorship . . . is limited to natural persons"). The extension of this phenomenon to computer programs is particularly controversial. See *id.* at 24-27; *infra* text accompanying note 46.

14. See, e.g., 1 LADAS, *supra* note 8, at 327-35 (international implications of national laws on employee inventions); Ricketson, *supra* note 7, at 22-24.

15. See, e.g., 1 LADAS, *supra* note 8, at 327 (de facto consensus of civil-law countries on use of special legislation to provide reasonable compensation of employee-inventors in return for employers' ability to claim and exploit employee inventions). Whether harmonization is progressive or regressive depends on the evaluator's point of view, however. Compare, e.g., Ricketson, *supra* note 7, at 23-24 (contending that choice-of-law rules applicable to cases involving foreign copyright litigants should always favor the law of the country where protection is claimed, both as to authorship and scope of protection issues) with Jane C. Ginsburg & Pierre Sirinelli, *Authors and Exploitations in International Private Law: The French Supreme Court and the Huston Film Colorization Controversy*, 15 COLUM.-VLA J. L. & ARTS 135, 138-42 (1991) (criticizing application of French law to determine authorship of American film for purposes of adjudicating alleged moral rights violation).

16. The Berne Convention, *supra* note 7, art. 1, provides that the "countries to which this Convention applies constitute a Union for the protection of the rights of authors in their literary and artistic works." The Paris Convention, *supra* note 6, art. 1(1) provides that the "countries to which this Convention applies constitute a Union for the protection of industrial property." Article 1(2) then declares that the "protection of industrial property has as its object patents, utility models, industrial designs, trademarks . . ." and the like. For the importance of the distinction between "art" and "inventions" in conceptualizing the problems of protecting new technologies, see Reichman, *Programs as Know-How*, *supra* note 3, at 648-62.

17. See, e.g., Berne Convention, *supra* note 7, art. 2(1) (establishing list of works for which domestic copyright protection is mandatory); Ricketson, *supra* note 7, at 8-10 (stressing consensus as to works covered by early versions of Berne Convention, including scientific works amounting to original intellectual creations). With respect to the Paris Convention, however, no mandatory list of patentable subject matters was ever agreed upon. Rather, member states are obligated to provide national treatment for all forms of

systems that govern art and inventions perform different economic and social functions, they operate with different policy biases when attributing patrimonial rights to authors or inventors.¹⁸ Even though the specific rules attributing ownership of artistic works or of patented inventions often vary from country to country, the classical separation of artistic from industrial property norms ensured that differences with respect to subject matter within the domain of art did not affect the domain of inventions and vice versa.¹⁹ The traditional lines of demarcation between the Paris and Berne Conventions thus kept unresolved or troublesome proprietary issues within relatively well-defined jurisdictional compartments.²⁰

A. OWNERSHIP OF INVENTIONS AND WORKS OF AUTHORSHIP

The classical patent system rewards disclosures of significant inventions that elevate competition based on routine technological skills to its next highest level, while driving lesser forms of innovation into the open market.²¹ In theory, individual inventors propel this system and receive both the moral and proprietary rights it bestows, as reflected in the requirement of United States law that the actual inventors must file their own patent applications regardless of their employment status.²²

industrial property, as defined by art. 1, and to recognize certain international minimum rights with respect to those subject matters that are patentable under the domestic patent laws. See Paris Convention, *supra* note 7, arts. 1, 2(1); BODENHAUSEN, *supra* note 7, at 13-16, 24-25. See also J.H. Reichman, *Intellectual Property in International Trade: Opportunities and Risks of a GATT Connection*, 22 VAND. J. TRANSNAT'L L. 747, 848-54 (1989) [hereinafter Reichman, *GATT Connection*].

18. See *infra* text accompanying notes 21-38.

19. See, e.g., Baker v. Selden, 101 U.S. 99 (1879); Pamela Samuelson, *Computer Programs, User Interfaces, and Section 102(b) of the Copyright Act of 1976: A Critique of Lotus v. Paperback*, 55 LAW & CONTEMP. PROBS. 311, 324-31 (1992) [hereinafter Samuelson, *Critique of Lotus*]; see generally *Programs as Know-How*, *supra* note 3, 693-95 n.288.

20. See, e.g., P. Bernt Hugenholtz, *Convergence and Divergence in Intellectual Property Law: The Case of the Software Directive*, in INFORMATION LAW TOWARDS THE 21ST CENTURY, *supra* note 3, 319, 320 ("In the old days, cumulative protection by copyright and patent laws would have been unthinkable"). Industrial designs, however, always escaped these compartments and thus presaged many of the problems that new technologies have made more acute. See *infra* notes 39, 54-56, 377-91 and accompanying text.

21. See, e.g., Graham v. John Deere Co., 383 U.S. 1 (1966); Bonito Boats, Inc. v. Thunder Craft Boats, Inc., 489 U.S. 141 (1989); JAY DRATLER, JR., *INTELLECTUAL PROPERTY LAW: COMMERCIAL, CREATIVE, AND INDUSTRIAL PROPERTY* § 1.05[1] (1992); Paul Goldstein, *The Competitive Mandate: From Sears to Lear*, 59 CAL. L. REV. 873 (1971). See also Michael Lehmann, *Property and Intellectual Property: Property Rights as Restrictions on Competition in Furtherance of Competition*, 20 I.I.C. 1, 10-11 (1989); Edmund W. Kitch, *Nature and Function of the Patent System*, 20 J.L. & ECON. 265 (1977).

22. See 35 U.S.C. § 102(f) (1988); 6 DONALD S. CHISUM, *PATENTS*, § 22.03[2] (rev. ed. 1993); see also Jończyk, *supra* note 7, at 856-57 (stating that the "sole unquestionable employee's right in the invention is the right to be named as inventor, that is, the moral,

In practice, patents are freely assignable,²³ and the standard employment contract (including the employment contracts of most research universities) now provides either expressly or by implication for an immediate assignment of employee inventions to the employer in exchange for salary and other benefits intended to compensate employees for their discoveries.²⁴ Even in the absence of a contractual duty to assign, courts concerned about the efficient allocation of resources to research and development conducted by large business organizations have increasingly viewed employee inventions as falling within the scope of employment. Such inventions belong to the employers who hired the employees to make them.²⁵

In contrast, copyright systems have traditionally governed the specialized markets for literary and artistic works in which economic efficiency is but one of several competing policy goals that aim to promote both the welfare of single artists and the cultural well-being of

personal right called inventorship," which is universally accepted).

23. 35 U.S.C. § 261 (1988). The federal patent law does not regulate ownership of the patent, which is determined by the various state laws. *See infra* notes 67-68 and accompanying text (distinguishing "ownership" from "inventorship").

24. *See, e.g.*, 1 LADAS, *supra* note 8, at 326 (noting that such an assignment is unnecessary if the employee was hired to invent); Mark B. Baker & Andre J. Brunel, *Restructuring the Judicial Evaluation of Employed Inventors' Rights*, 35 ST. LOUIS U. L.J. 399, 399-412 (1991) (noting the further tendency to award employer's shop rights even in inventions falling outside the scope of employment but made with some employer resources). *See also* Jay Dratler, Jr., *Incentives for People: The Forgotten Purpose of the Patent System*, 16 HARV. J. ON LEGIS. 129, 141-48 (1979) (noting that the term "inventions" usually implies reduction to practice and not just conception); *infra* notes 67-69 and accompanying text. An implicit duty to assign ownership of an employee invention is sometimes premised on the notion that the employees were fiduciaries or alter-egos of the employer's enterprise. *See, e.g.*, *Dowse v. Federal Rubber Co.*, 254 F. 308 (E.D. Ill. 1918); *Kennedy v. Wright*, 676 F. Supp. 888 (C.D. Ill. 1988); *Tripp v. United States*, 406 F. 2d 1066 (Ct. Cl. 1969). *But see* Pat K. Chew, *Faculty Generated Inventions: Who Owns the Golden Egg?*, 1992 WIS. L. REV. 259, 264, 289-90 (criticizing this doctrine and contending that courts remain "reluctant to infer . . . an assignment").

25. *See, e.g.*, *United States v. Dubilier Condenser Corp.*, 289 U.S. 178, *amended*, 289 U.S. 706 (1933) (establishing hired-to-invent doctrine); 2 PETER D. ROSENBERG, *PATENT LAW FUNDAMENTALS* § 11.04[1] (rev. ed. 1992) (stressing that, in the absence of a contractual assignment, the employer must establish that the invention was actually the object of the inventor's employment); Jończyk, *supra* note 7, at 857-58 (noting that, while ownership based on the inventor principle used to be the norm, today "the employed inventor is the rule and . . . the economic ownership right . . . is usually vested in the employer . . . who contributes to the invention and . . . has the appropriate potential to commercialize it" for economic and social progress). *See also infra* note 85. The level of compensation due to the employee-inventor, however, remains controversial, *see* Jończyk, *supra* note 7, at 862-72, and the economic assumptions underlying the pro-employer bias have been criticized. *See, e.g.*, Baker & Brunel, *supra* note 24, at 409-19.

the community at large.²⁶ Copyright systems normally vest human authors with pecuniary and moral rights to original works that bear the stamp of the creators' own personalities.²⁷ There is also a presumption that authors retain all rights except those explicitly covered by written transfer agreements.²⁸

Moreover, in countries following the "droit d'auteur" rather than the "copyright" tradition, authors' rights cannot ordinarily vest in legal or corporate entities at all.²⁹ In these countries, the employer obtains an assignment, transfer or license permitting use of the copyrighted work for purposes consistent with the scope of employment. The author usually retains all other rights, including both moral rights and rights to commercial uses outside the scope of employment.³⁰ Legislation in "droit d'auteur" countries may also regulate the terms of any grants or

26. See, e.g., FRÉDÉRIC POUILLAUD-DULIAN, *LE DROIT DE DESTINATION* 106-07 (1989) (concluding that, while industrial property law aims to stimulate commercial and industrial activity, copyright law promotes the creator's individual personality and the culture at large); J.H. Reichman, *Goldstein on Copyrights: A Realist's Approach to a Technological Age*, 43 STAN. L. REV. 943, 947-49 (1991) [hereinafter, *Realist's Approach*]; see also 1 STEPHEN P. LADAS, *THE INTERNATIONAL PROTECTION OF LITERARY AND ARTISTIC PROPERTY* 1-12 (1938).

27. See, e.g., 17 U.S.C. §§ 102(a), 201(a) (1988); Jan Corbet, *Le développement technique conduit-il a un changement de la notion d'auteur?* [Does Technological Development Imply a Change in the Notion of Author?], 148 R.I.D.A. 58, 60-61, 74 (1991) (stating that the "classic conception of originality implies that the work must bear a stamp of the author's personality"). See also Jeremy Phillips, *The Concept of "Author" in Copyright Law—Some Reflections on the Basis of Copyright Law in the United Kingdom*, 26 COPYRIGHT 26, 26-27 (1990). For the international obligation to protect an author's moral rights, see Berne Convention, *supra* note 7, art. 6bis; RICKETSON, *supra* note 11, at 157-60, 893-903. For the situation in the U.S., see Edward J. Damich, *The Right of Personality: A Common Law Basis for the Protection of the Moral Rights of Authors*, 23 GA. L. REV. 1 (1988). The decision by the European Economic Communities to protect computer programs in copyright law breaks with the "droit d'auteur" tradition by recognizing corporate employers as authors where the domestic legislation so provides. See Council Directive on the Legal Protection of Computer Programs, 91/250/EEC, No. L 122/42, 17.5.91, reprinted in OFFICIAL J. EUR. COMMUNITIES, May, 1991 [hereinafter EEC Directive on Computer Programs].

28. See, e.g., 17 U.S.C. §§ 202, 204 (1988); Corbet, *supra* note 27, at 62. See also Ghislain Roussel, *The Copyright of Salaried and Employed Authors—A Comparative Study of National Laws*, 26 COPYRIGHT 221, 222-23 (1990).

29. See, e.g., S.M. STEWART, *INTERNATIONAL COPYRIGHT AND NEIGHBOURING RIGHTS* 6-7 (2d ed. 1989); Corbet, *supra* note 27, at 60. For statutory recognition of corporate employers as authors in United States law, see 17 U.S.C. § 201(b) (1988).

30. See, e.g., Roussel, *supra* note 28, at 222. The employer's rights thus derive from the author's own exclusive rights, which vest in the latter by dint of creation. Uses by the author that fall outside the scope of employment must not undermine the employer's own exploitation rights. Moreover, the author's reserved rights of commercial exploitation are said to be waivable by agreement in most countries. *Id.*

assignments between authors and publishers, with a view to strengthening the authors' bargaining power.³¹

The systemic biases favoring employers in patent law and disfavoring employers in copyright law do not produce satisfactory results in every instance, even without taking into account the advent of new technologies that fit imperfectly within the classical intellectual property mold. For example, non-recognition of legal entities as "authors" in the "droit d'auteur" countries complicated the international protection of cinematographic works under the Berne Convention³² and helped to relegate phonograms and broadcasts to neighboring rights regimes.³³ In countries that do recognize corporate employers as "authors" for copyright purposes, such as the United States and the United Kingdom,³⁴ determining when particular works fall within the made-for-hire category raises troublesome legal and economic issues that recent legislative compromises have not put to rest.³⁵

On the patents side of the ledger, the standard allocation of ownership to employers may deprive employees of sufficient incentives to maximize

31. See, e.g., STEWART, *supra* note 29, at 7; Adolf Dietz, *Germany, Federal Republic*, in INTERNATIONAL COPYRIGHT LAW AND PRACTICE § 4[2] (Paul Edward Geller ed., 1990) (German law forbids irrevocable assignment of whole copyright); *id.* at § 4[3][a] (noting that detailed regulations of old Publishing Act of 1901 continue to apply, but are not mandatory, and may be superseded by individual contracts); Mario Fabiani, *Italy*, in INTERNATIONAL COPYRIGHT LAW AND PRACTICE, *supra*, § 4[3] (setting out mandatory norms governing publishing agreements and performance agreements under Italian law, which were adopted "in order to establish rules to protect authors").

32. See generally RICKETSON, *supra* note 11, at 549-89; Corbet, *supra* note 27, at 62-68 (discounting the complications and arguing that "the technique of film-making did not create the slightest need to abandon the classic conceptions of authorship within the Romano-Germanic tradition").

33. See, e.g., STEWART, *supra* note 29, at 185, 189-90; Ricketson, *supra* note 11, at 14-20. In contrast, the United States Copyright Act of 1976 recognized producers of phonograms and broadcasts as "authors," see 17 U.S.C. §§ 101 (definitions of "audiovisual works" and "sound recordings"), 102(a)(6), 102(a)(7), 106, 201(b) (1988 & Supp. 1991); and the United Kingdom's Copyright, Designs and Patents Act, 1988, ch. 48 (Eng.), see *infra* notes 396-97, has widened the concept of "author" in this and still other respects. See, e.g., Phillips, *supra* note 27, at 28 (criticizing use of the term "author" to cover not only the creator of a work but also the person entitled to neighboring rights).

34. See *supra* notes 29-30; *infra* text and authorities accompanying notes 118-29.

35. See, e.g., Community for Creative Non-Violence v. Reid, 490 U.S. 730 (1989); Roussel, *supra* note 28, at 226-29; I.T. Hardy, *Copyright Law's Concept of Employment—What Congress Really Intended*, 35 J. COPYRIGHT SOC'Y 210 (1988); Rochelle Dreyfuss, *The Creative Employee and the Copyright Act of 1976*, 54 U. CHI. L. REV. 590 (1987). See also I.T. Hardy, *An Economic Understanding of Copyright Law's Work-Made-for-Hire Doctrine*, 12 COLUM.-VLA J.L. & ARTS 181, 195-227 (1988) [hereinafter Hardy, *Economic Understanding*] (arguing that, in employment cases, courts do and should allocate "authorship" to the "better exploiter," i.e., the "party with the greater resources").

their inventive talents beyond the scope of their employment.³⁶ Reconciling the employees' needs to exploit their talents in future job opportunities with the employers' needs to maintain effective patent protection also raises troublesome policy issues.³⁷ The particularly disadvantageous position of employee-inventors under United States law could also constitute a competitive handicap "in what has become an increasingly global employee workforce."³⁸

B. A NEW GENERATION OF PROPRIETARY RIGHTS ISSUES

Since the 1960s, clumsy efforts to adapt the world's intellectual property system to important new technologies have broken down the classical line of demarcation separating artistic from industrial property.³⁹ The integrity of this division had already been undermined by the tendency of some countries to protect industrial designs under both artistic and industrial property laws.⁴⁰ Its collapse in the face of overwhelming protectionist demands⁴¹ complicates still unresolved policy issues surrounding conventional objects of protection, and it has also spawned a new generation of proprietary rights issues that are being superimposed upon those previously discussed.⁴²

One new set of proprietary issues results from internal distortions of the copyright and patent paradigms themselves. For example, European courts have begun to alter the classic conception of originality in their domestic copyright laws in order to accommodate computer programs,

36. See, e.g., Baker & Brunel, *supra* note 24, at 411 (stating that common-law rules governing employed inventors ignore monopoly effects, adverse effects on the direction of inventive activity, and the need to stimulate innovation); Jończyk, *supra* note 7, at 869 (expressing the view that over-reliance on salary and social security benefits may adversely affect innovation); Dratler, *supra* note 24. Cf. M. Yokoyama, *Stimulating Inventive Activity in Enterprises—Employees' Invention Systems—Systems for Supporting Inventive Activity*, 27 INDUS. PROP. 389 (1988).

37. See, e.g., Tibor Z. Gold, *Entitlement Disputes: A Case Review*, 12 E.I.P.R. 382, 382-86 (1990). Cf. *infra* text and authorities accompanying notes 279-88.

38. Chew, *supra* note 24, at 285.

39. See *Programs as Know-How*, *supra* note 3, at 648-67; *infra* text and authorities accompanying notes 50-59, 402-06.

40. See J.H. Reichman, *Design Protection and the New Technologies: The United States Experience in a Transnational Perspective*, 19 U. BALT. L. REV. 6, 136-41 (1989/90) [hereinafter Reichman, *Designs and New Technologies*].

41. See, e.g., Dennis S. Karjala, *Copyright, Computer Software, and the New Protectionism*, 28 JURIMETRICS J. 33, 40-41 (1987).

42. See, e.g., Pamela Samuelson, *Allocating Ownership Rights in Computer-Generated Works*, 47 U. PITT. L. REV. 1185 (1986) [hereinafter Samuelson, *Allocating Ownership Rights*]; Paul Goldstein, *General Report: Computer-Assisted and Computer-Generated Creation of Literary and Artistic Works*, in ALAI, L'INFORMATIQUE ET LE DROIT D'AUTEUR 439 (1990); J.H. Reichman, *Proprietary Rights in Computer-Generated Productions*, in WIPO SYMPOSIUM, *supra* note 4, 205, 206-09, 213-14 [hereinafter Reichman, *Computer-Generated Productions*].

which seldom bear the stamp of an author's personality.⁴³ While the European Community's recent Directive on Software could permanently dilute the pre-existing standard of authorship,⁴⁴ the United States Supreme Court has strengthened the traditionally low originality requirement of American copyright law.⁴⁵ The Software Directive also appears to weaken the proprietary rights normally afforded employee creators in "authors' rights" countries, notwithstanding the formal assimilation of computer programs to other literary works.⁴⁶ In patent law, meanwhile, a perceived dilution of the "nonobviousness" standard⁴⁷

43. See, e.g., Corbet, *supra* note 27, at 74-78 (criticizing German and French judicial decisions). See also RICKETSON, *supra* note 11, at 897-903.

44. See EEC Directive on Computer Programs, *supra* note 27, arts. 1(3) (attempting to establish independent creation standard), and 2 (allowing legal entities to be authors where domestic legislation permits and allocating all pecuniary rights in employee creations to the employer unless otherwise agreed); BRIGET CZARNOTA & ROBERT J. HART, *LEGAL PROTECTION OF COMPUTER PROGRAMS IN EUROPE—A GUIDE TO THE EC DIRECTIVE* 43-44 (1991) (stressing intention of drafters to impose pure test of noncopied, independent creation). See also Corbet, *supra* note 27, at 78 (criticizing draft Directive for emphasis on a generically creative contribution not contingent upon the personal expression of a human author); Linda G. Morrison, *The EC Directive on the Legal Protection of Computer Programs: Does It Leave Room for Reverse Engineering Beyond the Need for Interoperability?*, 25 VAND. J. TRANSNAT'L. L. 293, 308-10 (1992) (stressing requirement of independent creation). Use of the term "intellectual creation" in art. 1(3) of the Directive as adopted, however, could leave some room for judicial interpretation at the national level. See, e.g., CZARNOTA & HART, *supra*, at 45 (acknowledging this possibility). Even so, the Directive has subjected the classical continental concept of originality to a "process of reinterpretation." See Hugenholz, *supra* note 20, at 320-21.

45. See *Feist Publications v. Rural Telephone Serv.*, 111 S.Ct. 1282 (1991); Howard B. Abrams, *Originality and Creativity in Copyright Law*, 55 LAW & CONTEMP. PROBS. 3, 9-33 (1992); Dennis S. Karjala, *Copyright and Misappropriation*, 17 U. DAYTON L. REV. 885, 894-917 (1992). For earlier federal appellate decisions moving in this direction, see *Realist's Approach*, *supra* note 26, at 949-55. See also L. Ray Patterson & Craig Joyce, *Monopolizing the Law: The Scope of Copyright Protection for Law Reports and Statutory Compilations*, 36 UCLA L. REV. 719, 728-31 (1989) (advocating stronger standard of originality not based on effort or "sweat of the brow"). But see Jane C. Ginsburg, *Creation and Commercial Value: Copyright Protection of Works of Information*, 90 COLUM. L. REV. 1865, 1881-1900 (1990) (criticizing personality-based theories of copyright protection and distinguishing between low- and high-authorship works).

46. See *supra* notes 29-31 and accompanying text; Corbet, *supra* note 27, at 78-82 (criticizing the French Copyright Law of 1985 for initiating this trend, which the EC Directive further elaborates). Direct attempts to weaken the rights of independent contractors in *droit d'auteur* countries were, however, abandoned prior to final adoption of the Directive, and moral rights were left to the provisions of the Berne Convention. See CZARNOTA & HART, *supra* note 44, 9-10, 47-51. Whether the single member countries will respect the *droit d'auteur* tradition in their implementing legislation without an obligation under the Directive to do so remains to be seen.

47. 35 U.S.C. § 103 (1988) (requiring that patentable invention not be obvious to one skilled in the prior art); *Graham v. John Deere Co.*, 383 U.S. 1 (1966). See A. Samuel Oddi, *Beyond Obviousness: Invention Protection in the Twenty-First Century*, 38 AM. U. L. REV. 1097, 1120-28 (1989); Kevin Rhodes, *The Federal Circuit's Patent Nonobviousness Standards: Theoretical Perspectives on Recent Doctrinal Changes*, 85 NW. U. L. REV. 1051,

applicable to computer program-related inventions in the United States⁴⁸ has spawned a potentially large class of inventors and proprietors, the validity and scope of whose initial claims await judicial evaluation.⁴⁹

Another set of proprietary rights problems results from the growing tendency to apply different legal regimes to essentially the same subject matter. Concurrent protection of computer program-related innovation by copyright, patent and design patent laws in the United States is an obvious case in point.⁵⁰ Less obvious is the extent to which software manufacturers attempt to combine copyright and trade secret protection of their underlying source codes, which are seldom disclosed even to university scientists.⁵¹ Particularly aggressive strategies that use copyright law to inhibit reverse engineering of computer programs distributed on the open market have begun to elicit resistance from the federal appellate courts.⁵² Computer program manufacturers are also

1055-76, 1101 (1991); Robert P. Merges, *Uncertainty and the Standard of Patentability*, 7 HIGH TECH L.J. 1, 20-64 (1992).

48. See, e.g., COMPUTER SCIENCE AND TELECOMMUNICATIONS BOARD, NATIONAL RESEARCH COUNCIL, INTELLECTUAL PROPERTY ISSUES IN SOFTWARE 63-66 (1991) [hereinafter INTELLECTUAL PROPERTY ISSUES IN SOFTWARE].

49. To the extent that the nonobviousness standard is applied too loosely to computer programs, the consequences will be magnified by the elimination of most subject-matter constraints on patentability in the recent case law. See, e.g., *Diamond v. Diehr*, 450 U.S. 175 (1981); *Arrhythmia Research Technology, Inc. v. Corazonix Corp.*, 958 F.2d 1053 (Fed. Cir. 1992) (holding that claims to a specific process or apparatus implemented in accordance with a mathematical algorithm will generally satisfy patent statute). See also Richard H. Stern, *Tales from the Algorithm War: Benson to Iwahashi, It's Deja Vu All Over Again*, 18 AIPLA Q.J. 371, 390-91 (1991); Samuelson, *Benson Revisited*, *supra* note 4, at 1092-94, 1099-1102, 1113-14; Donald S. Chisum, *The Patentability of Algorithms*, 47 U. PITT. L. REV. 959 (1986).

50. See Samuelson, *CONTU Revisited*, *supra* note 4; Daniel J. Kluth & Steven W. Lundberg, *Design Patents: A New Form of Intellectual Property Protection for Computer Programs*, 70 J. PAT. & TRADEMARK OFF. SOC'Y 847 (1988); Reichman, *supra* note 40. See also Pamela Samuelson, *Survey on the Patents Copyright Interface for Computer Programs*, 17 AIPLA Q.J. 256 (1989).

51. See, e.g., INTELLECTUAL PROPERTY ISSUES IN SOFTWARE, *supra* note 48, at 29-31, 75-77 (expressing concern that source codes are not disclosed even to university scientists); David Bender, *Protection of Computer Programs: The Copyright/Trade Secret Interface*, 47 U. PITT. L. REV. 907 (1986). See also RANALD ROBERTSON, *LEGAL PROTECTION OF COMPUTER SOFTWARE* 2-34 (1990) (U.K. perspective); John R. Harris, *A Market-Oriented Approach to the Use of Trade Secret or Copyright Protection (or Both?) for Software*, 25 JURIMETRICS J. 147, 156-64 (1985).

52. See *infra* notes 199-203 and accompanying text. See also David A. Rice, *Public Goods, Private Contract and Public Policy: Federal Preemption of Software License Prohibitions Against Reverse Engineering*, 53 U. PITT. L. REV. 543 (1992) [hereinafter Rice, *Reverse Engineering*].

trying to bring user interfaces within unfair competition laws whose protective thrust is potentially unlimited in duration.⁵³

This phenomenon is by no means confined to computer programs under United States law. For example, the anomalous extension of full copyright protection to ornamental designs of useful articles under French law at the end of the nineteenth century⁵⁴ and even to purely functional designs under British law in the period 1975-1988⁵⁵ has been followed by legislation affording copyright-like protection to integrated circuit designs in most industrialized countries⁵⁶ and to functional designs of every kind in the United Kingdom.⁵⁷ A growing academic constituency now demands copyright protection for genetically altered organisms despite the availability of patent protection for the same

53. See, e.g., *Engineering Dynamics, Inc. v. Structural Software, Inc.*, 785 F. Supp. 576, 583-84 (E.D. La. 1991) (noncopyrightable design of input and output reports not likely to be confused with competing design for purposes of Lanham Act § 43(a)); Richard Armstrong Beutel, *Trade Dress Protection for the "Look and Feel" of Software: The Lanham Act as an Emerging Source of Proprietary Rights Protection for Software Developers*, 71 J. PAT. & TRADEMARK OFF. SOC'Y 974, 983-88 (1989). Cf. *Designs and New Technologies*, *supra* note 40, at 81-123; Ulrich Loewenheim, *Legal Protection for Computer Programs in West Germany*, 4 HIGH TECH. L.J. 187, 195, 198-200 (1989).

54. See, e.g., Yves Gaubiac, *La théorie de l'unité de l'art*, 111 R.I.D.A. 3 (1982). See also J.H. Reichman, *Design Protection in Domestic and Foreign Copyright Law: From the Berne Revision of 1948 to the Copyright Act of 1976*, 1983 DUKE L.J. 1143, 1153-70 [hereinafter Reichman, *Designs Before 1976*]; J.H. Reichman, *Design Protection After the Copyright Act of 1976: A Comparative View of the Emerging Interim Models*, 31 J. COPYRIGHT SOC'Y 267, 283-97 (1984).

55. Before the passage of the United Kingdom's Copyright, Designs and Patents Act, 1988, ch. 48 (Eng.), British courts had begun to protect three-dimensional product designs in copyright law if they had first been depicted in two-dimensional technical drawings, a practice overruled by the Act. See, e.g., Christine Fellner, *The New United Kingdom Industrial Design Law*, 19 U. BAL. L. REV. 369, 71-72 (1989/90); *infra* notes 361, 377-89 and accompanying text. See also ROBERT MERKIN, RICHARDS BUTLER ON COPYRIGHT, DESIGNS AND PATENTS: THE NEW LAW 283-95, 361 (1989).

56. See, e.g., Robert W. Kastenmeier & Michael J. Remington, *The Semiconductor Chip Protection Act of 1984: A Swamp or Firm Ground?*, 70 MINN. L. REV. 417 (1985); Charles R. McManis, *International Protection for Semiconductor Chip Designs and the Standard of Judicial Review of Presidential Proclamations Issued Pursuant to the Semiconductor Chip Protection Act of 1984*, 22 GEO. WASH. J. INT'L L. & ECON. 331 (1988). See *infra* notes 299-303, 342-43 and accompanying text.

57. Copyright, Designs and Patents Act, 1988, ch. 48, §§ 213-264 (Eng.) (instituting unregistered design right). See, e.g., W.R. CORNISH, *INTELLECTUAL PROPERTY: PATENTS, COPYRIGHT, TRADE MARKS AND ALLIED RIGHTS* 384-91 (2d ed. 1989); Fellner, *supra* note 55, at 377-88; *infra* text accompanying notes 357-91.

organisms,⁵⁸ and these pressures will subject the classical intellectual property system to even greater strain in the future.⁵⁹

Disregarding, for a moment, the larger systemic crisis to which this leads,⁶⁰ one little explored consequence of these trends is that they multiply occasions in which a single creative production will become subject to different legal regimes operating with different authorship and ownership criteria. As new technologies entering the world's intellectual property system increasingly attract an array of overlapping protective regimes, the rules for attributing the proprietary rights characteristic of each separate regime also overlap in a bewildering pattern of concurrent and sometimes contradictory legal and policy goals. Over time, these contradictions could destabilize the industrialized countries' institutional capacity to generate technological innovation, or at least slow the pace at which such innovation is transferred from the laboratory to commercial exploitation. To illustrate these dangers, the next section of this study examines a number of characteristic legal problems that result from the application of overlapping proprietary regimes to computer programs developed in a university environment.

58. See, e.g., MICHAEL A. EPSTEIN, *MODERN INTELLECTUAL PROPERTY* 434-48 (2d ed. 1989); Doreen M. Hogle, *Copyright for Innovative Biotechnological Research: An Attractive Alternative to Patent or Trade Secret Protection*, 5 *HIGH TECH. L.J.* 75 (1990); Donna Smith, Comment, *Copyright Protection for the Intellectual Property Rights to Recombinant Deoxyribonucleic Acid: A Proposal*, 19 *ST. MARY'S L.J.* 1083 (1988); Irving Kayton, *Copyright in Living Genetically Engineered Works*, 50 *GEO. WASH. L. REV.* 191 (1982). Biogenetically altered plant varieties, if sexually propagated, are conceivably subject to both the Plant Variety Protection Act of 1970, *supra* note 2, and the patent law, at least to the extent that the plant or parts thereof are seen as the product of a patentable process. See, e.g., *In re Pleuddemann*, 910 F.2d 823 (Fed. Cir. 1990); *In re Durden*, 763 F.2d 1406 (Fed. Cir. 1985). See also Noel J. Byrne, *Plants, Animals, and Industrial Patents*, 16 *I.I.C.* 1 (1985); R. Stephen Crespi, *Patents and Plant Variety Rights: Is There an Interface Problem?*, 23 *I.I.C.* 168 (1992).

59. See, e.g., Joseph Straus, *Biotechnology and Its International Legal and Economic Implications*, Study Prepared for the United Nations Conference on Trade and Development (UNCTAD), Geneva, Switzerland, January, 1988; Rebecca S. Eisenberg, *Property Rights and the Norms of Science in Biotechnology Research*, 97 *YALE L.J.* 177 (1987); Korn, *supra* note 10, at 192. See also R. Stephen Crespi, *Inventiveness in Biological Chemistry: An International Perspective*, 73 *J. PAT. & TRADEMARK OFF. SOC'Y* 351 (1991).

60. See *supra* notes 4, 39; *infra* text and authorities accompanying notes 403-06.

II. OVERLAPPING PROPRIETARIAL CLAIMS TO COMPUTER-RELATED UNIVERSITY RESEARCH: A MICRO-LEGAL SURVEY

Let us imagine that a professor of physics at an American university⁶¹ developed a computer program in connection with an on-going research project. For purposes of this exercise, the professor is assumed to be a full-time employee of the university, who was hired to teach and conduct research. It is further assumed that the professor's research product could qualify as patentable subject matter under current United States law and that it might satisfy the novelty, utility and nonobviousness requirements of patent protection,⁶² which the authorities are now interpreting rather liberally to accommodate computer program-related inventions.⁶³ Given these assumptions, there are at least four principal sets of proprietary claims likely to arise, plus a number of ancillary claims that may also come into play once the program moves further along the stream of industrial exploitation. The principal claims stem from: 1) the federal patent law; 2) contractual agreements implementing the university's own patents policy; 3) federal copyright law; and 4) contractual agreements implementing the university's policies governing copyrights in particular and unpatented technologies in general. Ancillary claims are most likely to arise under state trade secret laws but could also derive from the Semiconductor Chip Protection Act of 1984,⁶⁴ from trademark and unfair competition laws at both the state and federal levels,⁶⁵ and from any *sui generis* design law that Congress may eventually enact.⁶⁶

61. To keep the scope of this exercise within manageable bounds, primary references are to pertinent U.S. law. Parallel references to U.K. law are frequently provided, and some effort is made to identify areas in which the two country's laws may diverge.

62. See 35 U.S.C. §§ 101, 102, 103 (1988).

63. See *supra* note 49 and accompanying text; see also Ronald S. Laurie, *The Patentability of Artificial Intelligence Under U.S. Law*, in WIPO SYMPOSIUM, *supra* note 4, at 121, 121-50. The same assumptions could not, however, be made in the U.K. In that country, subject-matter eligibility of computer program-related inventions remains more restricted than in the U.S., and the validity of issued patents under the basic criteria of eligibility can more easily be challenged as a defense to an infringement action. See, e.g., ROBERTSON, *supra* note 51, at 129-37 (concluding that, "[a]s a general rule . . . there will be a major question mark over whether most programs can be patented at all" under U.K. law).

64. Semiconductor Chip Protection Act of 1984, 17 U.S.C. §§ 901-914 (1988 & Supp. 1991); see *infra* text accompanying notes 221-53, 299-344.

65. See *supra* note 53; *infra* notes 392-93 and accompanying text.

66. See Ralph S. Brown, *Copyright-Like Protection for Designs*, 19 U. BALT. L. REV. 308 (1989/90); J.H. Reichman, *Design Protection and the Legislative Agenda*, 55 LAW & CONTEMP. PROBS. 281, 292-95 (1992). In 1988, the United Kingdom adopted an unregistered design right on modified copyright principles, in addition to the Registered Design Act of 1949, which operates on modified patent principles. See *infra* notes 363-91 and accompany-

A. PRIMARY REGIMES

1. Ownership of University-Generated Patents

For proprietary purposes, one must distinguish between inventorship—as determined by federal law—and ownership, which is largely governed by state common law and which usually derives from an express or implied agreement on the part of employees to assign to employers all rights in any inventions made or conceived by the employees in the course of employment.⁶⁷ In the absence of an employment agreement covering the subject of employee-made inventions, the employee will in principle own any inventions made on his own time and at his own expense. An employee's patent may still remain subject to the employer's "shop right," that is, to the employer's nonexclusive license to make and use the invention if the inventor used the employer's facilities or resources in developing an invention outside the scope of his employment.⁶⁸ As a practical matter, however, in both the United States and the United Kingdom, employee-created inventions will belong to employers if, as usually occurs, the duties assigned to the employees

ing text.

67. See 35 U.S.C. § 261 (1988) (treating patents as personal property that may be assigned to any legal or natural person and leaving the ownership of patents largely to state law, including the question of whether an employee must assign a patent to his employer); 2 ROSENBERG, *supra* note 25, §§ 11.01, 11.04[1]; *supra* notes 22-25 and accompanying text. Although federal law may technically determine that the patent vests in the employee-inventor for purposes of attribution, state law normally determines an inventor's employment status, and most employees labor under a contractual obligation to assign the patent. See, e.g., William P. Hovell, *Patent Ownership: An Employer's Rights to His Employee's Invention*, 16 INTELL. PROP. L. REV. 93, 94-96 (1984); Dratler, *supra* note 24, at 131-32, 141-48 (raising doctrinal objections to these contracts, but confirming the likelihood of their enforcement). For current university contracts requiring assignments of patents, see *infra* note 79 and accompanying text.

68. See, e.g., *United States v. Dubilier Condenser Corp.*, 289 U.S. 178, 188-89 (1933); 2 ROSENBERG, *supra* note 25, § 11.04[1]; Dratler, *supra* note 24, at 134, 138-40. See also *supra* note 25. The existence of a "shop right" depends on the employer's having made some significant contribution. In contrast, "when an employee not assigned to invent makes an invention on his own time, without using the supplies or facilities of his employer and pays the expenses of obtaining the patent out of his own pocket, the invention belongs to him, and his employer has no rights in it, whether or not the subject matter of the invention relates to the employer's business." Dratler, *supra* note 24, at 138 (citing authorities). The courts, however, have tended to expand the availability of shop rights in keeping with an overall judicial preference for awarding patent rights to the party contributing capital. See, e.g., *Baker & Brunel*, *supra* note 24, at 404-15 (criticizing this preference on economic grounds). See also Hovell, *supra* note 67, at 94-96 (citing authorities); Ronald B. Coolley, *Recent Changes in Employee Ownership Laws: Employers May Not Own Their Inventions and Confidential Information*, 41 BUS. LAW. 57, 58 (1985).

indicate that they were hired to make such inventions or that the inventions actually made fell within the scope of employment.⁶⁹

In the university environment, a professor is normally hired to conduct research within a particular subject-matter area in addition to his or her teaching and administrative duties. That research usually benefits from the inputs of colleagues and student assistants as well as from more tangible university facilities and resources. These factors suggest that, even in the unlikely event that the employment contract between a university and its faculty members failed to allocate rights to patented inventions, courts could find that the university owned any inventions made within the scope of employment.⁷⁰

To the extent that an inventive professor does benefit from the contributions of both colleagues and students, these contributions may rise to the level of joint inventorship.⁷¹ A joint inventorship exists when the parties worked together "in a cooperative effort to solve a problem,"

69. See, e.g., 2 ROSENBERG, *supra* note 25, § 11.04[1]; CORNISH, *supra* note 57, at 176-80; *supra* note 25; *infra* note 85. In the U.K., § 39 of the Patents Act of 1977 designates the employer as first proprietor where an invention was made in the normal course of employment. See CORNISH, *supra*. The U.K. thus regulates ownership of employee inventions by statute, whereas this determination is left to state law in the U.S. Under U.S. law, the invention will not vest in the employer merely because it falls within the scope of employment unless the employee was hired to invent it; the employer's ownership otherwise depends on an assignment under the pre-invention employment contract. See 2 ROSENBERG, *supra* note 25, § 11.04 [1]. U.S. law may, however, make it easier to show that an employee-invention, although made with the use of an employer's resources, did not fall within the terms of the employment contract. In such doubtful cases, the American employer may obtain only a "shop right," i.e., a free license to use, but this will not prevent the employee from licensing the invention to others. See *supra* notes 67-68. See also Audrey A. Horton, *Opportunities and Pitfalls in Research and Development Agreements*, 13 E.I.P.R. 213, 215 (1991).

70. See, e.g., 1 LADAS, *supra* note 8, at 324-25 (concluding that employers should be deemed the owners of inventions when research activity is a primary task of the employee). Whether an implied duty to assign the invention to the university might result would depend on all the circumstances, including the motive for the lack of an express agreement to assign, as posited in the text. See, e.g., *University Patents, Inc. v. Kligman*, 762 F. Supp. 1212 (E.D. Pa. 1991) (reasonable jury could find implied contract to assign patent to university when evidence showed professor knew of patent policy, manifested intent to be bound, and used university resources); Chew, *supra* note 24, who argues that university professors should not be treated like other industrial employees when adjudicating these issues. See also Charles Weiner, *Patenting and Academic Research: Historical Case Studies*, in OWNING SCIENTIFIC AND TECHNOLOGY INFORMATION: VALUE AND ETHICAL ISSUES 87-109 (Vivian Weil & John W. Snapper eds. 1989) [hereinafter OWNING SCIENTIFIC INFORMATION]. A court inclined to treat university professors differently could view them as employees not hired to invent any specific inventions for their university employers. See *supra* notes 67-68; *infra* notes 257-59 and accompanying text. Even so, the university might assert a "shop right" to the invention. See *supra* note 68. In practice, such questions infrequently reach the courts because most university employment contracts now expressly allocate the rights to patented inventions. See *infra* text accompanying notes 79-82.

71. See 35 U.S.C. §§ 102(f), 116 (1988).

and each made "a mental contribution to the final conception of the solution."⁷² Merely following instructions or reducing an idea to practice will not suffice.⁷³ But since the 1984 amendments to § 116 of the Patent Law, it has become easier for university scientists and researchers to advance claims of joint inventorship, even though they worked on only a particular aspect of an invention.⁷⁴ Provided that some collaboration actually took place, the joint inventors need not have worked together at the same time, nor must each make the same type or amount of contribution, nor must each contribute to the matter specified in every claim of the patent.⁷⁵

Once a joint inventorship exists, and there is no agreement to the contrary, each of the inventors becomes a co-owner of the patent as a whole. As co-owners, each then has the unlimited right to make, use or sell the patented invention without the consent of the other co-owners and without a duty to account to them for profits received.⁷⁶ In the United States, but apparently not in the United Kingdom, a co-owner's share is also transferable to a third party without the consent of other co-owners.⁷⁷ The rules concerning joint inventorship thus differ from the

72. See John O. Tresansky, *Joint Inventorship*, 7 AIPLA Q. J. 96, 108-09 (1979).

73. See, e.g., *Mueller Brass Co. v. Reading Indus.*, 352 F. Supp. 1357, 1372 (E.D. Pa. 1972), *aff'd*, 487 F.2d 1395 (3d Cir. 1973); 2 ROSENBERG, *supra* note 25, § 11.01 (stressing murky nature of joint inventorship tests and stating that mere reduction to practice will not qualify); Tresansky, *supra* note 72, at 101-03.

74. 35 U.S.C. § 116 (1988), as amended by Patent Law Amendments of 1984, Pub. L. No. 98-622, 98 Stat. 3383 [hereinafter 1984 Amendments]. Conversely, an amendment to 35 U.S.C. § 103 made it harder for single members of a university research team to preclude each other's claims to patentability. See Patrick D. Kelly, *Recent Changes in the Patent Law That Effect Inventorship and Ownership*, in OWNING SCIENTIFIC INFORMATION, *supra* note 70, at 61, 65-68. See also *infra* note 168 and accompanying text.

75. See *Kimberly-Clark Corp., v. Procter & Gamble Distrib. Co.*, 973 F.2d 911, 915-17 (Fed. Cir. 1992) (finding that even under § 116 as amended, parties could not be joint inventors if they had no contact whatsoever and were unaware of each other's work); David W. Carstens, *Joint Inventorship Under 35 U.S.C.S. §116*, 73 J. PAT. & TRADEMARK OFF. SOC'Y 616, 618-22, 631-34 (1991). For an outer limit, see 35 U.S.C. § 121 (1988) (requiring that claims be directed to a single invention).

76. See 35 U.S.C. § 262 (1988) ("In the absence of any agreement to the contrary, each of the joint owners of a patent may make, use or sell the patented invention without the consent of and without accounting to the other owners."); CORNISH, *supra* note 57, at 184-85. See also *Willingham v. Lawton*, 555 F.2d 1340, 1344 (6th Cir. 1977) (acknowledging the rule of § 262 notwithstanding that "[t]he unlimited use of a patent by one co-owner could effectively destroy the value of a patent to the other co-owner"); *Lemelson v. Synergistics Research Corp.*, 669 F. Supp. 642 (S.D.N.Y. 1987). Of course, unless all co-owners agree, it remains impossible to grant an *exclusive license* of the patented invention. See 2 ROSENBERG, *supra* note 25, § 11.05.

77. Compare Robert P. Merges & Lawrence A. Locke, *Co-Ownership of Patents: A Comparative and Economic View*, 72 J. PAT. & TRADEMARK OFF. SOC'Y 586, 586-87, 598 (1990) (criticizing American rule) with CORNISH, *supra* note 57, at 184-85 (stating British rule).

joint authorship doctrine of copyright law, which requires joint authors to account to one another for revenues gained.⁷⁸

In practice, both the professor and his university colleagues usually allocate any patent rights they acquire as inventors to their university by contractual agreement. With some notable exceptions, such as Stanford University, the employment contracts of most American and British universities require an assignment of all inventions that an employee makes with university resources or that fall within the scope of his or her employment, in return for a percentage of the royalties.⁷⁹ Such an express assignment would normally control the allocation of rights between the parties,⁸⁰ except that a growing number of states limit the enforceability of these agreements under Employee Invention statutes.⁸¹ If a contractual allocation in favor of the university remains valid despite these statutes, the American professor cannot assert any

78. See *infra* text and authorities accompanying notes 159-67.

79. See generally Chew, *supra* note 24, at 273-83 (finding that most U.S. universities claim ownership of patentable inventions, although Stanford, Wisconsin and Minnesota stand out among the exceptions); William T. McGrath, *University/Industry Relations in Research and Technology: Ownership and Licensing Issues* 11 (1992) (unpublished, on file with Vanderbilt University Law School). See also W.R. Cornish, *Rights in University Innovations: The Herchel Smith Lecture for 1991*, 14 E.I.P.R. 13, 15-17 (1992) (stating that most, but not all, U.K. universities base their rights to faculty-generated research on the contractual duty to pursue research). This contrasts with the practice in other countries, such as Germany and Sweden, where university professors retain ownership of patents subject to claims by the university for a share of the income attributable to research costs. *Id.* at 16.

As regards U.S. universities, Professor Chew identifies three basic approaches: (1) universities that claim ownership of faculty generated research inventions only if university resources are used (deemed "resource-provider" approach); (2) those that claim ownership if university resources are used or the invention was developed in the course of employment (deemed "maximalist approach"); (3) those that claim any invention developed by faculty without regard to use of university resources or course of employment (deemed "supra-maximalist approach"). Chew, *supra* note 24, at 273-81.

80. See, e.g., 6 CHISUM, *supra* note 22, § 22.03[1]; 2 ROSENBERG, *supra* note 25, § 11.04[1]; Chew, *supra* note 24, at 286. For a discussion of certain reservations and legal nuances that might hinder the enforcement of contractual assignments by university faculty member under some circumstances, see *id.* at 286-93.

81. Statutes in several states may void agreements to assign employee inventions that are contained in employment contracts when (1) none of the employer's resources were used in creating the invention; and (2) the invention was developed entirely on the employee's own time; and (3) the invention does not relate to the employer's business; and/or (4) the invention does not result from any work performed by the employee for employer. See, e.g., Coolley, *supra* note 68; Baker & Brunel, *supra* note 24, at 414-15 (noting that these statutes attempt to rectify the disincentive to the employee to invent outside the field of the employer's business, but not the disincentive to invent within that same field). Such statutes have been adopted in Minnesota, Kansas, California, Washington, North Carolina and Illinois. See Baker & Brunel, *supra*, at 414. Because the statutory language differs slightly from state to state, the particular combination of the four factors that an employee must prove in order to gain the benefit of the statute varies accordingly. See also Coolley, *supra* note 68.

claim to equitable remuneration over and above the terms provided in the contract, as his English counterpart might be tempted to do.⁸² In the absence of an enabling clause in the contract, there are even doubts about either the American or British professor's unfettered ability to disclose a patentable invention to the public in disregard of the university's proprietary interests, a prospect that raises troubling issues of law and policy examined below.⁸³

A student collaborator, in contrast, such as a paid research assistant who acts as a principal investigator, may not have entered any such contractual arrangement with the university. In such a case, he or she could be entitled to all the privileges of co-ownership, provided that the student contributed significantly to the final conception of the inventive solution.⁸⁴ If, instead, the contributing students had become university employees in order to receive compensation, an express or implied contract could allocate their patent rights to the university.⁸⁵ In the

82. See, e.g., ROBERTSON, *supra* note 51, at 138-39 (discussing §§ 39-43 of the Patents Act of 1977 (Eng.), which allow an employee a fair share of the returns if the invention was "of outstanding benefit to an employer and it is 'just' that an employee should be awarded compensation"). See also Gold, *supra* note 37, at 382-85; Jończyk, *supra* note 7, at 863-68; *supra* note 9 (discussing civil law approach).

83. See, e.g., Cornish, *supra* note 79, at 16; McGrath, *supra* note 79, at 5-8; *infra* text and authorities accompanying notes 269-73. For other policy considerations that may influence a university not to claim faculty-generated inventions, see Chew, *supra* note 24, at 282-86.

84. See *supra* notes 72-75 and accompanying text.

85. At M.I.T., for example, the patents policy treats "[s]tudents, faculty and other researchers hired by the university . . . the same." Lita L. Nelsen, *Intellectual Property and the University*, in BIOTECH '92 at 361, 368 (MCLE ed. 1992). An implied contractual obligation upon an employee to assign patents to the employer will arise when the employee is hired, or is later directed, to invent a specific invention or solve a specific problem. See, e.g., 6 CHISUM, *supra* note 22, § 22.03[2]; Robert L. Gullette, *State Legislation Governing Ownership Rights in Inventions Under Employee Invention Agreements*, 62 J. PAT. OFF. SOC'Y 732, 733 (1980); Hovell, *supra* note 67, at 93, 96, 98. When an employee is hired or directed merely to pursue his inventive instincts with no specific invention anticipated, the employer's argument for an implied contract to assign the patent will have less force. See Hovell, *supra* note 67, at 98. See also *supra* note 25. Even then, some authorities justify imposing an implied contractual obligation to assign the patent when the employee created the invention during working hours, when the patent falls within the scope of the employer's business, or the employee was assigned the task of inventing a similar invention. See, e.g., *United States v. Dubilier Condenser Corp.*, 289 U.S. 178 (1933); 6 CHISUM, *supra* note 22, at 22-24 (noting that an implied contract to assign the invention will not arise when the employee is hired or directed merely to make improvements in a designated area). Cf. RESTATEMENT (SECOND) OF AGENCY, § 397 cmt. a (1957).

Some leading American commentators disapprove of implied contracts to assign patents premised on the existence of an employment relationship without more. See, e.g., 6 CHISUM, *supra* note 22, at 22-25 to 22-26 (suggesting that, in general, an implied contractual obligation to assign patents should not arise when the employee has been hired or directed merely to "do research" or to "improve" or "design" products); 2 ROSENBERG, *supra* note 25, § 11.04[1], at 11-20 (declaring that "[n]o duty on the part of a 'general' employee to assign inventions made during the course of employment arises from the employment relationship

absence of any such contractual allocation, a university that had made some significant contribution, such as furnishing equipment, materials or other resources, might still qualify for a "shop right," that is, a non-exclusive, non-transferable and royalty-free license to make, use and sell the student's invention.⁸⁶

The few universities that do not require faculty members to assign patentable inventions, such as Stanford, may likewise retain shop rights, which facilitate future research at these universities. The existence and scope of a shop right is, however, usually hard to determine in particular circumstances without litigation.⁸⁷ For example, shop rights may not extend to new lines of business or to new uses of an invention that arise after the responsible investigators leave the university.⁸⁸ Even if the right exists, the university may not be in a position to make direct use of the invention.⁸⁹

So far, this exercise has proceeded on the assumption that the pertinent computer program-related invention might qualify for patent protection. In practice, even if it were to satisfy both the subject-matter and eligibility requirements of the patent law, an issued patent would protect only against unauthorized use of the novel matter claimed to distinguish the patented program-related invention from the prior art⁹⁰ and only to the extent permitted by an increasingly restrictive

absent an employment contract to that effect," and citing *Great Lakes Press Corp. v. Froom*, 695 F. Supp. 1440 (W.D.N.Y. 1987)). *But cf.* *University Patents, Inc. v. Kligman*, 762 F.Supp. 1212 (E.D.Pa. 1991); *Speck v. North Carolina Dairy Foundation, Inc.*, 319 S.E.2d 139 (1984), discussed *infra* in text accompanying notes 266-68.

86. See, e.g., 6 CHISUM, *supra* note 22, § 22.03[3][a]; 2 ROSENBERG, *supra* note 25, § 11.04[1]; Hovell, *supra* note 67, at 69, 99, 103. A "shop right" might also arise when, without demanding a royalty or other compensation, the employee knowingly allowed the employer to invest in preparations for using the invention in the employer's business, or when other circumstances allow a court equitably to imply a royalty-free license agreement with the employer. See 6 CHISUM, *supra* note 22; Hovell, *supra* note 67.

87. See, e.g., 2 ROSENBERG, *supra* note 25, § 11.04[1]; 6 CHISUM, *supra* note 22, § 22.03[3][a] (finding that courts tend to make case-by-case assessments of "whether it is fair for the employee to have all rights, given the parties' respective contributions to the conception, reduction to practice, commercial development of the idea").

88. See 6 CHISUM, *supra* note 22, § 22.03[3][e].

89. See Chew, *supra* note 24, at 270 (proposing that reimbursement by faculty members for the use of university resources may be more appropriate than the shop right in some cases). See also Baker & Brunel, *supra* note 24, at 404-13 (criticizing existing shop right doctrine on economic and public policy grounds and proposing reforms). For the view that university researchers should benefit from an experimental use exception to the exclusive rights of a patented invention to advance the progress of science, see Rebecca S. Eisenberg, *Patents and the Progress of Science: Exclusive Rights and Experimental Use*, 56 U. CHI. L. REV. 1017, 1074-78 (1989).

90. See, e.g., 1 ROSENBERG, *supra* note 25, § 6.01[5] (discussing point of novelty test, which disallows a finding of infringement when the sole point of similarity is not a novel feature that bore on the threshold claims to eligibility in the first instance). The point of novelty test is often used to narrow the scope of protection for patented designs. See, e.g.,

doctrine of equivalents.⁹¹ Many components or features of a patented program-related invention would thus fall outside the scope of the patent for one of three reasons: (1) they did not meet the threshold standards of novelty, nonobviousness and utility or (2) they were not deemed to be patentable subject matter or (3) because they relied on prior art that could not directly or indirectly be claimed.⁹² Over time, most program-related innovations will probably not qualify for patent protection at all because the patent paradigm excludes routine engineering solutions by definition.⁹³

Avia Group Int'l, Inc. v. L.A. Gear Cal., Inc., 853 F.2d 1557, 1565 (Fed. Cir. 1988). See generally Reichman, *Designs and New Technologies*, *supra* note 40, at 43-45, 51-53 (citing other authorities and showing importance of this test in Court of Appeals for the Federal Circuit's current treatment of design patents). The point of novelty test appears well-suited to computer program-related inventions owing to the incremental nature of innovation in this field and to the non-patentability of many features or components under rules that exclude scientific principles, mathematical formulas and algorithms, and business ideas. See, e.g., *In re Grams*, 888 F.2d 835 (Fed.Cir. 1989); Samuelson, *Benson Revisited*, *supra* note 4, at 1076-83, 1118-20. See also DRATLER, *supra* note 21, § 2.02[2]. But see, e.g., *In re Walter*, 618 F.2d 758, 766 (C.C.P.A. 1980).

91. The doctrine of equivalents applies when attempts are made to avoid literal infringement of a patent by recourse to relatively slight or well-known variations in the claimed product or process. The doctrine of equivalents, which relaxes the rule of strict construction of the claimed invention, interdicts colorable variations that perform substantially the same function as the patented invention in substantially the same way to obtain the same result. See, e.g., *Graver Tank & Mfg. Co. v. Linde Air Prods. Co.*, 339 U.S. 605, 608 (1950) (setting forth the function-way-result test of equivalents); *Pennwalt Corp. v. Durand-Wayland, Inc.*, 833 F.2d 931, 934-35 (Fed. Cir. 1987) (holding that infringement under the doctrine of equivalents can be shown only when every element of the claim or its substantial equivalent is present in the accused device), *cert. denied*, 485 U.S. 961, and *cert. denied sub nom.*, *Durand-Wayland, Inc. v. Pennwalt Corp.*, 485 U.S. 1009 (1985); *Wilson Sporting Goods v. David Geoffrey & Assocs.*, 904 F.2d 677 (Fed. Cir.), *cert. denied*, 111 S. Ct. 537 (1990) (limiting scope of equivalents by hypothetical claim to accused product, which, had it not been allowed by patent authorities over prior art should not amplify patentee's equivalents in infringement suit). See also Martin J. Adelman & Gary L. Francione, *The Doctrine of Equivalents in Patent Law: Questions that Pennwalt Did Not Answer*, 137 U. PA. L. REV. 673 (1989). Fundamental or "pioneer" inventions are entitled to a broader range of equivalents than inventions based on small advances in the art, which receive only a narrow scope of protection. See, e.g., DRATLER, *supra* note 21, § 2.05[3][b][i]. See also Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839 (1990).

92. See *Wilson Sporting Goods*, 904 F.2d at 677; *supra* notes 48-49, 62-63 and accompanying text.

93. See *supra* notes 49, 62-63 and accompanying text. For the view that implementing a well-defined process in a programming language is always obvious and, therefore, not patentable, see Gary Dukarich, *Patentability of Dedicated Information Processors and Infringement Protection of Inventions That Use Them*, 29 JURIMETRICS J. 135, 165, 194 (1989).

In all these cases, the putative "inventors" could presumably seek concurrent protection in copyright law.⁹⁴ To the extent that copyright law applied, it would allocate the relevant proprietary rights according to different legal principles that respond to different policy goals.

2. Ownership of Copyrights in Commercialized University Research

a. Statutory Criteria of Authorship and Ownership

In Anglo-American copyright law, both authorship and ownership are linked with the requirement of originality, which characteristically demands "only that a copyrighted work be independently created and not copied from another source."⁹⁵ Because an author's personality is always unique, independent creation of almost any artistic work necessarily displays the personal expression that constitutes the defining attribute of authorship.⁹⁶ Even so, authorship and independent creation remain distinct legal concepts, and courts interpret the requirement of an "original work of authorship" under § 102(a) of the United States Copyright Act of 1976 to entail a modicum of quantitative creativity over and above the mere fact of independent creation.⁹⁷ Taken together, these threshold requirements constitute only modest barriers to eligibility, in deference to the universally recognized principle of nondiscrimination that forbids any test of aesthetic merit.⁹⁸

Requirements of authorship and minimal creativity become important when the works at issue consist largely of matter already in the public domain, or when external factors—such as functional exigencies, technical standards or market expectations—limit a creator's opportunities for subjective, personal expression. For example, the federal appellate courts sporadically excluded borderline utilitarian works, such as commercial designs and rudimentary compilations of data, for lack of

94. See *supra* note 50 and accompanying text; see also Cornish, *supra* note 79, at 14-15; Gregory J. Maier, *Software Protection—Integrating Patent, Copyright and Trade Secret Law*, 69 J. PAT. & TRADEMARK OFF. SOC'Y 151 (1987).

95. 1 PAUL GOLDSTEIN, *COPYRIGHT: PRINCIPLES, LAW AND PRACTICE* § 2.2.2 (1989 & Supp. 1992). See also CORNISH, *supra* note 57, at 268-71. Although the Copyright Act of 1976 did not define "author," the U.S. Supreme Court specified that an author was the person "to whom anything owes its origin," i.e., the "originator" or "maker." *Burrow-Giles Lithographic Co. v. Sarony*, 111 U.S. 53, 57-58 (1884). See also *Community for Creative Non-Violence v. Reid*, 490 U.S. 730, 737 (1989) (defining author as "the party who actually creates the work" by "translat[ing] an idea into a fixed, tangible expression entitled to copyright protection").

96. *Bleistein v. Donaldson Lithographing Co.*, 188 U.S. 239, 251 (1903).

97. See 17 U.S.C. § 102(a) (Supp. 1991); *Feist Publications v. Rural Telephone Service*, 111 S. Ct. 1282, 1289 (1991); *Abrams*, *supra* note 45, at 9-14.

98. See, e.g., *Bleistein*, 188 U.S. at 251; WIPO GUIDE, *supra* note 7, at 13.

creative authorship⁹⁹ even before the Supreme Court's landmark decision in *Feist Publications v. Rural Telephone Service*.¹⁰⁰ In *Feist*, the United States Supreme Court denied copyright protection to the listings of a telephone directory on the grounds that "an original work of authorship" must Constitutionally entail more than "sweat of the brow" labor or diligent efforts.¹⁰¹ At least one court has denied copyright protection to independently created elements of a computer program whose features were dictated by technological constraints.¹⁰² These and other cases demonstrate the beginning of a methodological convergence between domestic and foreign courts (except British courts) in evaluating the copyrightability of borderline utilitarian productions whose market value is not determined by personal expression.¹⁰³

Whether the "authorship" requirement in § 102(a) also implies that a copyrighted work should be created directly by human beings remains an open question.¹⁰⁴ United States law contains no provision comparable to that of the British Copyright, Designs and Patents Act of 1988, which purports to deal with proprietary rights in computer-generated works.¹⁰⁵ The British law, however, applies only to the rare work

99. See, e.g., *L. Batlin & Son, Inc. v. Snyder*, 536 F.2d 486 (2d Cir.), cert. denied, 429 U.S. 857 (1976); *Financial Info., Inc. v. Moody's Investors Serv.*, 808 F.2d 204 (2d Cir. 1986), cert. denied, 484 U.S. 820 (1987). See generally *Realist's Approach*, supra note 26, at 952-53 (describing pre-*Feist* trend).

100. 111 S. Ct. 1282 (1991). For developments since *Feist*, see *Abrams*, supra note 45, at 20-33.

101. *Feist*, 111 S. Ct. at 1285; see Paul J. Heald, *The Vices of Originality*, 1991 SUP. CT. REV. 143, 145-49.

102. See *Secure Servs. Technology v. Time & Space Processing*, 722 F. Supp. 1354, 1363 (E.D. Va. 1989). See also *Manufacturers Technologies v. Cams*, 706 F. Supp. 984, 995 (D. Conn. 1989). But see *Lotus Dev. Corp. v. Paperback Software Int'l*, 740 F. Supp. 37 (D. Mass. 1990); Samuelson, *Critique of Lotus*, supra note 19, at 324-37. Still other courts reached comparable results at the infringement stage by declining to find any quantum of protectible matter in independently created works that defendants had closely or slavishly imitated. See, e.g., *Data East USA, Inc. v. Epyx, Inc.*, 862 F.2d 204 (9th Cir. 1988); *Frybarger v. IBM Corp.*, 812 F.2d 525 (9th Cir. 1987). Very recent federal appellate decisions have refined the tests for excluding non-protectible matter from the infringement calculus in computer software cases. See *infra* notes 193-203 and accompanying text.

103. See generally *Realist's Approach*, supra note 26, at 949-55 (citing authorities); Hugenholtz, supra note 20, at 320-21. See also Jessica Litman, *The Public Domain*, 39 EMORY L.J. 965, 966, 1004-19 (1990). The threshold standards of U.S. copyright law are more exigent than those of the U.K., which appear to accept diligence, effort and skill of a kind that would not necessarily qualify as an "original work of authorship" under U.S. law. See CORNISH, supra note 57, at 268-71. But U.S. law seems still to require less than "the personal intellectual creation" of German law; and it probably remains less demanding than similar standards in the laws of some other European Community countries despite growing convergence in this respect.

104. See, e.g., 1 GOLDSTEIN, supra note 95, § 2.2.2; Ricketson, supra note 7, at 20-24 (arguing that both letter and spirit of the Berne Convention require "that the author should be a natural person").

105. See *infra* note 396 and accompanying text.

generated "in circumstances such that there is no human author."¹⁰⁶ Because most computer-generated works still entail some human creativity,¹⁰⁷ both British and American courts are normally thrown back upon more traditional principles of authorship and ownership not governed by this provision.¹⁰⁸

Assuming that a given work satisfies the originality and authorship prerequisites, its copyright protection arises automatically with the act of creation, which by definition occurs when the work is fixed in any tangible medium of expression.¹⁰⁹ Accordingly, the question of initial ownership is not muddled by the need to comply with certain formalities, as occurs with patents.¹¹⁰ Instead, the Copyright Act of 1976 vests ownership of all works not made for hire in the authors—that is, in the persons who independently created them—even though these authors may have contracted to assign the copyrights to third parties.¹¹¹ In the case of multiple creators who intended to merge their contributions into inseparable or interdependent parts of a single work, each person who contributes copyrightable expression becomes a joint author and co-owner of the copyright in the work.¹¹²

106. Copyright, Designs and Patents Act, 1988, ch. 48, § 9(3) (Eng.). See *infra* notes 396-99; CORNISH, *supra* note 57, at 355.

107. Cases in which there is no human author at all, as this section requires, are hard to envision, although future applications of artificial intelligence might fit the bill. See, e.g., Davis, *supra* note 4; Reichman, *Electronic Information Tools*, *supra* note 5, at 830-38. For a thoughtful discussion of the proprietary problems likely to arise even though "the human author is never absent if there is a computer-produced work," see Péter Gyertyánfy, *Copyright Protection of Computer-Produced Creations*, in WIPO SYMPOSIUM, *supra* note 4, at 229, 231-34.

108. Professor Goldstein predicts that United States courts facing similar problems will probably analyze the issues raised by automated productions in terms of ownership and infringement rather than as issues of originality and authorship. See 1 GOLDSTEIN, *supra* note 95, § 2.2.2. Contractual agreements governing the use of computer programs to create new works would then presumably be relied upon to allocate rights in the works created. See also Arthur R. Miller, *Computers and Authorship: The Copyrightability of Computer-Generated Works*, in WIPO SYMPOSIUM, *supra* note 4, at 241, 257 (reviewing precedents suggesting that the recognition of copyrightable authorship in computer-generated productions "does not require that a general rule be formulated for identifying the author"); Samuelson, *Allocating Ownership Rights*, *supra* note 42, at 1200-04, 1227-28 (stressing statutory and policy reasons favoring allocation of authorship to program users under certain conditions).

109. 17 U.S.C. §§ 101 (definitions of "created," "fixed," "copies" and "phonorecords"), 102(a) (1988 & Supp. 1991).

110. See 35 U.S.C. §§ 102, 103, 111, 131, 151, (1988); *supra* note 22 and accompanying text. Cf. CORNISH, *supra* note 57, at 317.

111. See 17 U.S.C. § 201(a) (1988). See also *id.* § 101 (1988); 1 GOLDSTEIN, *supra* note 95, § 4.2.

112. See 17 U.S.C. §§ 101 (definition of "joint work") and 201(a) (1988); Ashton-Tate Corp. v. Ross, 916 F.2d 516 (9th Cir. 1990). On this view, if one of the collaborators contributes only ideas and not expression, that party will not be deemed a joint author. See, e.g., Childress v. Taylor, 945 F.2d 500, 507 (2d Cir. 1991); BancTraining Video Sys. v. First

Because ownership of the copyright vests initially in non-employee creators by operation of law, subsequent owners normally acquire their divisible exploitation rights by dint of some transfer from the original authors.¹¹³ The author or certain statutory heirs may then terminate these transfers after thirty-five years¹¹⁴ and thereby recapture all rights released at a time when the transferor may have held an inferior bargaining position.¹¹⁵ However, derivative works already made under the initial transfer agreement are not subject to termination,¹¹⁶ nor are licenses granted to foreigners under foreign law.¹¹⁷ Moreover, the termination provisions do not affect works made for hire, which is one of the principle reasons that the definition of this term assumed particular importance in the legislative history of the 1976 Act.¹¹⁸

Works made for hire typically consist of works prepared by an employee within the scope of his or her employment,¹¹⁹ and their term of protection endures for a period of seventy-five years from first publication or 100 years from creation, whichever is shorter.¹²⁰ In both the United States and the United Kingdom, the copyrights to such works vest in the firm or corporation that employed the creator and not in the true creator himself. Technically, the employer for whom the work was prepared "is considered the author" for statutory purposes and, unless otherwise agreed, "owns all of the rights comprised in the copyright."¹²¹ Because works made for hire are not subject to termination rights of any

Am. Corp., 21 U.S.P.Q.2d (BNA) 2014 (6th Cir. 1992) (unpublished) (employee who provided ideas and supervised production not a joint author). *But see* *Andrien v. Southern Ocean County Chamber of Commerce*, 927 F.2d 132, 135-36 (3d Cir. 1991); 1 MELVILLE B. NIMMER & DAVID NIMMER, NIMMER ON COPYRIGHT § 6.07 (1992).

113. See 17 U.S.C. §§ 101 (definition of "transfer of copyright ownership"), 201(a), 201(d) (1988).

114. See 17 U.S.C. §§ 203(a)(3), 304(c) (1988). Textual discussion is confined to grants executed after January 1, 1978, which are covered by § 203.

115. See, e.g., M. William Krasilovsky & Robert S. Meloni, *Copyright Law as a Protection Against Improvidence: Renewals, Reversions, and Terminations*, 5 COMM. & L. 3 (1983).

116. See 17 U.S.C. § 203(b)(1) (1988). Those who lawfully created derivative works prior to termination may thus continue to exploit them under the terms of the original transfer agreement, even though they may not create any new derivative works after termination without the consent of the copyright owner. *Cf. Mills Music, Inc. v. Snyder*, 469 U.S. 153 (1985).

117. See 17 U.S.C. § 203(b)(5) (1988); 3 NIMMER, *supra* note 112, § 11.02[B][2]. In this respect, foreign licensees may be placed in a better position than their domestic counterparts.

118. See 17 U.S.C. § 203(a) (1988); 1 GOLDSTEIN, *supra* note 95, § 4.9.1.3.

119. See 17 U.S.C. § 101 (1988) (definition of "work made for hire").

120. See 17 U.S.C. § 302(c) (1988). Copyrights vesting in works not made for hire last for the lifetimes of the authors plus fifty years thereafter. *Id.* § 302(a).

121. 17 U.S.C. § 201(b) (1988). See also CORNISH, *supra* note 57, at 318.

kind, employee creators can never reclaim the statutory rights of authorship and ownership that vested in their employers.¹²²

Most commissioned works escape the disfavored status of employee works, however, because the 1976 Act—as recently interpreted by the United States Supreme Court—generally attributes ownership of commissioned works to non-salaried independent contractors.¹²³ The Act reserves work-for-hire status for certain specially commissioned works that fall within nine designated subcategories in which employers are likely to have contributed the bulk of any authorship these works contain.¹²⁴ In principle, a specially commissioned work of a type not listed in the nine categories could still qualify as an employee work under general principles of agency law. But the Supreme Court apparently de-emphasized the element of supervision or control that was decisive under prior law and made it harder to deviate from the literal reading of the Act itself, which favors the specially commissioned author rather than the hiring party.¹²⁵

The enhanced status of specially commissioned works benefits photographers, many computer programmers¹²⁶ and even architects,

122. See 17 U.S.C. §§ 203(a), 304(c) (1988). See also Russ Versteeg, *Copyright and the Educational Process: The Right of Teacher Inception*, 75 IOWA L. REV. 381, 386 (1990) (noting that if an art teacher creates a painting in the course of classroom instruction, attributing ownership of the copyright to teacher or school will determine who controls bundle of exclusive rights, duration of the copyright, and whether a transferee's rights may be terminated after 35 years).

123. See *Community for Creative Nonviolence v. Reid*, 490 U.S. 730 (1989); *Aymes v. Bonelli*, 980 F.2d 857 (2d Cir. 1992).

124. See 17 U.S.C. § 101 (1988) (defining "work made for hire" to include "a work specially ordered or commissioned for use as a contribution to a collective work, as a part of a motion picture or other audiovisual work, as a translation, as a supplementary work, as a compilation, as an instructional text, as a test, as answer material for a test, or as an atlas, if the parties expressly agree in a written instrument signed by them that the work shall be considered a work made for hire"; and defining "supplementary work" to include "forewords, afterwords, pictorial illustrations, maps, charts, tables, editorial notes, musical arrangements, answer material for tests, bibliographies, appendixes, and indexes").

125. See *Community for Creative Non-Violence*, 490 U.S. at 751-52. Under the 1909 Act, creators of commissioned works, such as photographers, were disfavored by a judge-made presumption that the hiring party intended to become the copyright owner. This presumption was especially strong if the hiring party exercised a degree of control or supervision in the preparation of the work. See 1 GOLDSTEIN, *supra* note 95, § 4.3.1; 1 NIMMER, *supra* note 112, § 5.03[B][2][c]. Although the Supreme Court now emphasizes the payment of an employee's salary and benefits more than supervisory control, see *Community for Creative Non-Violence supra*, the Court's formulation is not free from ambiguity and could still depend on the extent to which "the ability to meaningfully exercise" an abstract legal right to control is a major factor. See HOWARD B. ABRAMS, *THE LAW OF COPYRIGHT* § 4.02[C][1][a][i] (1991).

126. See, e.g., *Aymes v. Bonelli*, 980 F.2d 857 (2d Cir. 1992) (finding programmer not an employee-creator even though corporation directed creation, because, among other reasons, employee benefits not paid). See also David L. Hayes, *Principles of Copyright Ownership with Application to Software*, 3 J. PROPRIETARY RTS., May 1991, at 2, 7-8;

now that architectural works receive full protection under the 1990 Amendments to the 1976 Act.¹²⁷ True, the hiring party can always attempt to secure either an assignment of the copyright or of all the exclusive rights pertinent to it, although this strategy may induce commissioned creators to raise their prices in some instances. Absent a written agreement to this effect, the courts will probably find that the independent contractor retained all rights not expressly bargained for; arguments that a doctrine devised to protect artistic contributions should not be used to protect computer programmers or technological innovators seem unlikely to prevail.¹²⁸ Moreover, the hiring party cannot buy the creator's termination rights, which are not waivable. Hence, even an assignment of the copyright or a transfer of all rights to specially commissioned works will revert to their creators upon termination of the transfers after thirty-five years.¹²⁹

b. Specific Application to University-Generated Software

To date, courts have found that most computer programs and components of computer programs, including microcode, satisfy the "original work of authorship" requirements,¹³⁰ although a spate of recent decisions has reopened the question of eligibility by extending the idea-expression analysis to all structural subcomponents that make up

Matthew R. Harris, Note, *Copyright, Computer Software, and Work Made for Hire*, 89 MICH. L. REV. 661, 684-90 (1990/91).

127. See Architectural Works Copyright Protection Act, Pub. L. No. 101-650, § 701 *et seq.*, 104 Stat. 5133 (1990).

128. See, e.g., *M.G.B. Homes, Inc. v. Ameron Homes, Inc.*, 903 F.2d 1486, 1491-92 (11th Cir. 1990); *Hudson v. Good Rush Messenger Serv., Inc.*, 1987 Copyright L. Dec. (CCH), ¶ 26,089 (S.D.N.Y. 1987); Hayes, *supra* note 126, at 7-8; Harris, *supra* note 126, at 685-88, 696. Moreover, obtaining assignments of rights will not transform the hiring party into a statutory author for purposes of foreign law. See *id.* at 695-96.

129. See 17 U.S.C. § 203(a)(5) (1988); *supra* text and authorities accompanying notes 113-18.

130. See, e.g., *Whelan Assoc. v. Jaslow Dental Lab.*, 797 F.2d 1222 (3d Cir. 1986), *cert. denied*, 479 U.S. 1031 (1987) (application program); *Apple Computer, Inc. v. Franklin Computer Corp.*, 714 F.2d 1240, 1249-54 (3d Cir. 1983), *cert. dismissed*, 464 U.S. 1033 (1984); *NEC Corp. v. Intel Corp.*, 10 U.S.P.Q.2d (BNA) 1177 (N.D. Cal. 1989) (finding microcode copyrightable). But see *Synercom Technology, Inc. v. University Computing Co.*, 462 F. Supp. 1003 (N.D. Tex. 1978) (finding no protectible subject matter in the ordering and sequence of data in data input formats); *Secure Servs. Technology v. Time & Space Processing*, 722 F. Supp. 1354, 1363 (E.D. Va. 1989) (finding that the "opportunities for original authorship within the constraints of the [communications] protocol are too limited to merit copyright status"); *Healthcare Affiliated Serv. v. Lippany*, 701 F. Supp. 1142, 1151-52 (W.D. Pa. 1988) (finding certain high-level design choices unprotectible). See generally 1 GOLDSTEIN, *supra* note 95, § 2.15.2; 1 NIMMER, *supra* note 112, § 2.18[J].

the program as a whole.¹³¹ To the extent that programs remain copyrightable, the initial inquiry is whether a program developed at a university by one of its professors should be treated as an employee work-for-hire.

Universities as Sui Generis Law-Givers

Although courts recognized a teacher's exception to the work-for-hire doctrine under prior law, the technical definition of works made for hire codified in the 1976 Act made no express exception for academic authors, and the legislative history ignored the relevant precedents.¹³² Some commentators believe that the literal language of the Act restored ownership of faculty-generated copyrights to schools and universities by operation of law,¹³³ and one decision affords some indirect support for this view.¹³⁴ In contrast, two major decisions and most treatise writers support the contrary thesis, that teachers are hired to teach and conduct research, not to produce specific works for their employers.¹³⁵ On this view, universities cannot exercise control over the manner and means of producing a given work without violating the canons of academic freedom; nor do faculty writings fall within the scope of employment in the sense that they are prepared for the direct use or benefit of the university.¹³⁶ While the issue remains unsettled, it seems likely that university authors in both the United States and the United Kingdom

131. See, e.g., *Computer Assocs. Int'l v. Altai, Inc.*, 982 F.2d 693 (2d Cir. 1992); *Brown Bag Software v. Symantec Corp.*, 960 F.2d 1465 (9th Cir. 1992); *infra* text accompanying notes 194-98.

132. See, e.g., *Hays v. Sony Corp. of Am.*, 847 F.2d 412, 416-17 (7th Cir. 1988) (noting failure of legislative history covering 1976 Act to mention teacher's exception); Dreyfuss, *supra* note 35, at 597-99; Leonard D. DuBoff, *An Academic's Copyright: Publish and Perish*, 32 J. COPYRIGHT SOC'Y 17, 26 (1984).

133. See, e.g., DuBoff, *supra* note 132, at 24-34; Todd F. Simon, *Faculty Writings: Are They "Works Made for Hire" Under the 1976 Copyright Act*, 9 J.C. & U.L. 485, 502-09 (1983); McGrath, *supra* note 79, at 14. See also Versteeg, *supra* note 114, at 386-88.

134. See *Weinstein v. University of Ill.*, 811 F.2d 1091, 1094-95 (7th Cir. 1987) (dicta).

135. See *Community for Creative Non-Violence v. Reid*, 490 U.S. 730, 751-52 (1989); *Hays v. Sony Corp. of Am.*, 847 F.2d 412, 416-17 (7th Cir. 1988) (indicating in dicta that the teacher's exception survived on the theory that such works are not prepared for the employer); 1 NIMMER, *supra* note 112, § 5.03[B][1][b][i]; ABRAMS, *supra* note 125, § 4.02[C][1][c]. See also Dreyfuss, *supra* note 35, at 597-600.

136. See ABRAMS, *supra* note 125, § 4.02[C][1][c][ii] (construing *Community for Creative Non-Violence* to this effect); Cornish, *supra* note 79, at 15 (stressing discretionary character of academic research, need to preserve moral rights, and necessity of freedom to publish). The use of university-supplied facilities pulls in the other direction. See, e.g., Laura G. Lape, *Ownership of Copyrightable Works of University Professors: The Interplay Between the Copyright Act and University Copyright Policies*, 37 VILL. L. REV. 223, 232-33, 257 (1992). Nevertheless, after extensive research, Professor Lape concludes that "the 1976 Act did not disturb the professor's exception from the work-made-for-hire doctrine; to the extent that such an exception ever existed, it continues to exist." *Id.* at 246.

will continue to benefit from a "teacher's exception" to the works-for-hire doctrine.¹³⁷

On this hypothesis, a university may nonetheless require instructors to assign the ownership of all copyrights in works created during the course of employment as a condition of their initial employment contracts.¹³⁸ The courts have not balked at enforcing such contracts,¹³⁹ although some questions of validity could arise under the 1976 Copyright Act and general contracts law,¹⁴⁰ or even under those state laws that regulate general assignments of employee inventions.¹⁴¹ Moreover, federal copyright law allows all exclusive rights comprised in a copyright to be transferred and owned separately.¹⁴² If the university acquired only certain exclusive rights, but not an assignment of the copyright, it would be entitled "to all of the protection and remedies accorded to the copyright owner," who in this case would be the academic authors of the works in question.¹⁴³

137. See, e.g., ABRAMS, *supra* note 125, § 4.02[C][1]; Cornish, *supra* note 79, at 15 (advancing same prediction, based on analogous problems arising under overly broad statutory provision on works for hire in Section 11 of U.K. Copyright Law, which on its face could apply to public service, charity work and education). Even if a university professor were found to be an employee-author for most purposes, there could always be a separate question as to whether any particular work actually fell within the scope of employment. These cases usually raise troublesome issues of law and fact. See, e.g., ROBERTSON, *supra* note 51, at 48. Cf. Cornish, *supra* note 79, at 16 (contrasting "execution of a specific programme of research, funded . . . by a Research Council or industrial inventor and the research done in the course of ordinary academic life"). For the view that schools and universities need the equivalent of a "shop right" with regard to their teachers' copyrightable creations, see Versteeg, *supra* note 122, at 406-12.

138. See, e.g., Hayes, *supra* note 126, at 8; Dreyfuss, *supra* note 35, at 627 n.126.

139. See, e.g., Weinstein v. University of Ill., 811 F.2d 1091, 1094 (7th Cir. 1987) (noting decision to this effect below, but raising doubts as to whether the work in question fell within the contractual provision). Cf. Regents of the Univ. of Colo. v. K.D.I. Precision Prod., 488 F.2d 261, 269 n.12 (10th Cir. 1973); Vitamin Technologists v. Wisconsin Alumni Research Found., 146 F.2d 941 (9th Cir. 1945) (*dicta*).

140. See, e.g., Lape, *supra* note 136, at 246-50 (construing the requirements of a writing in 17 U.S.C. §§ 201(b), 204(a) (1988)). As to general contracts law, cf. Chew, *supra* note 24, at 286-93 (discussing invalidating doctrines applicable to contractual assignments of employee inventions to employers, but concluding that "contract law generally will enforce employees' express assignment of their ownership rights in inventions to their employers"); Baker & Brunel, *supra* note 24, at 404-12 (finding that employee-inventors lack true freedom of contract).

141. See *supra* note 81 and accompanying text. Use of the term "inventions" in these state statutes may be flexible enough to extend to nonpatentable innovation. Particularly troublesome cases would then arise when the university professor claimed to have developed, say, a computer program on his own time and without extensive use of the university's resources. Cf. Avtec Sys. v. Peiffer, 805 F. Supp. 1312 (E.D. Va. 1992) (employee's improved version of employer's software developed during employee's own time not a work made for hire).

142. 17 U.S.C. § 201(d)(2) (1988).

143. 17 U.S.C. §§ 201(a), 201(d)(2) (1988). But see *id.* § 201(b) (works made for hire).

However, pressure to assign copyrights could anger important segments of the relevant academic communities. In the past, both American and British universities allowed teachers to retain the copyrights in their scholarly or artistic output; this policy applied to scientific and technological writings, too, notwithstanding the usual contractual burden on the respective faculty members to assign patentable inventions.¹⁴⁴ To forego the traditional copyright policy merely because copyright law now assimilates computer programs to literary works¹⁴⁵ would especially hurt liberal arts professors, who cannot ordinarily supplement their incomes with consultation fees. Yet, if the traditional policy is left intact, it would put professors developing copyrightable software in a better position than colleagues working in other technological disciplines, such as biogenetic engineering. This follows because these other technologies do not attract copyright protection, and university employment contracts traditionally require their academic creators to assign any patentable inventions to their universities.¹⁴⁶

Faced with this dilemma, a growing number of universities have begun to formulate a *sui generis* policy for computer software and certain other technologies, which deviates from the policy applicable to works emanating from liberal arts departments.¹⁴⁷ Both Stanford and Vanderbilt Universities, in particular, have taken steps to treat non-patentable computer software, data bases, industrial designs, biogenetic material and other tangible embodiments of technological research as quasi-indus-

144. See *Hays v. Sony Corp. of Am.*, 847 F.2d 412 (7th Cir. 1988); Simon, *supra* note 133, at 486; Cornish, *supra* note 79, at 15.

145. See 17 U.S.C. § 101 (Supp. 1991) (definitions of "literary works" and "computer program"); Cornish, *supra* note 79, at 14-15 (noting "the maverick effect of copyright in computer programs," which "destroy the separate pigeonholing of literary effort and scientific research").

146. See *supra* notes 79-83 and accompanying text; Cornish, *supra* note 79, at 15-16.

147. See generally Lape, *supra* note 136, at 252-64 (finding that, of 70 university policies examined, some 19 distinguished computer programs from other copyrightable works, with a view to asserting some form of ownership). See also Chew, *supra* note 24, at 275 (citing authorities). Professor Chew found that the trend was to formulate comprehensive coverage. Nevertheless, "[w]hile some schools are attempting to treat virtually all faculty intellectual work the same way [citing Minnesota and Harvard policies], others are developing different treatment for different classes of works [citing Texas and Stanford policies]," with copyrightable "products . . . and faculty-generated software . . . often treated differently." *Id.* at 275-76. See generally *id.* at 276-81. McGrath reports that California Institute of Technology (Cal Tech) and Cornell have both adopted *sui generis* policies applicable to software. While Cal Tech merely differentiates copyrights in software (which belong to the university) from other copyrights retained by faculty members, Cornell distinguishes "traditional works" from "encoded works" and provides for university ownership of the latter if their development entailed substantial use of university resources. See McGrath, *supra* note 79, at 15. For the more elaborate *sui generis* policies of Stanford and Vanderbilt Universities, see *infra* text at notes 148-52.

trial property, the ownership of which must be assigned to the respective universities.¹⁴⁸ This approach blurs the distinction between intellectual property rights that require formal application to a granting authority (notably utility patents, but also plant-variety rights, and design patents or, in the United Kingdom, registered design rights)¹⁴⁹ and rights arising from the act of creation itself (notably scholarly writings)¹⁵⁰ or from a fiduciary relationship (such as a duty to preserve confidential information).¹⁵¹ However, such distinctions are inevitably blurred and administratively unsound in an intellectual property universe prone to lavish greater commercial rewards on unpatented but sometimes copyrightable embodiments of applied scientific know-how than on full-fledged patented inventions.¹⁵²

Universities that formulate their own *sui generis* regimes to deal with applied know-how—in the absence of statutory regimes dedicated to the same end¹⁵³—will require faculty members to sign employment agreements that alter the proprietary allocation otherwise resulting from the treatment of both computer programs and data bases as literary works under federal copyright law.¹⁵⁴ Such regimes may also derogate from the basic copyright policies of these same universities as applied to other scholarly and artistic works, to the extent the universities normally allow academic authors to retain their copyrights.¹⁵⁵ At Stanford, this results, paradoxically, in university ownership of rights to non-patentable innovation despite a policy of allowing faculty to retain ownership of patented inventions.¹⁵⁶

United States copyright law nonetheless limits the effectiveness of these homemade *sui generis* regimes in ways that find no parallel in

148. See *supra* note 147 and accompanying text; Patent Review Committee, A Policy on Technology and Literary and Artistic Works, Vanderbilt University (2d rev. ed. 1993) (unanimously approved by faculty senate in 1993). See also Nelsen, *supra* note 85, at 365-66, 368 (M.I.T. treats ownership of software like ownership of patents and regulates ownership of tangible research property in much the same manner).

149. See, e.g., 35 U.S.C. § 111 (1988) (application for patent); Plant Variety Protection Act, *supra* note 2, § 2421 (applications for certificates of Plant Variety Protection to be filed with Department of Agriculture); Cornish, *supra* note 79, at 16-17.

150. 17 U.S.C. §§ 101, 102(a) (1988) ("copyright protection subsists . . . in original works of authorship fixed in any tangible medium of expression").

151. See *infra* notes 246-47 and accompanying text.

152. See, e.g., *Programs as Know-How*, *supra* note 3, at 656-67, 714-16 (identifying the need for *sui generis* legislation to protect "Incremental Innovation Bearing Know-How on Its Face"); *infra* text accompanying notes 402-06. But see Cornish, *supra* note 79, at 16-17 (advocating a university policy that implements the distinction criticized in the text).

153. See Reichman, *Legal Hybrids*, *supra* note 3, at 349-59.

154. See 17 U.S.C. § 201(a) (1988) ("Copyright . . . vests initially in the author or authors of the work"); *supra* notes 109-118 and accompanying text.

155. See Lape, *supra* note 136, at 253-55, 257-62; *supra* notes 144-52 and accompanying text.

156. See *supra* notes 79, 147-148 and accompanying text.

either domestic or foreign patent law. For example, assuming that the computer programs and data bases in question meet the stiffening requirements for eligibility in copyright law,¹⁵⁷ a university that obtains a contractual assignment of rights from faculty creators still remains vulnerable to a termination of the authors' proprietary interests after thirty-five years. Any contractual provision that purported to waive faculty members' rights to recapture their exclusive rights under § 203 of the 1976 Act would not be enforced.¹⁵⁸

Multiple Creative Contributions

Additional complications arise when non-faculty members of a research team, such as graduate students and research assistants, contribute significantly to a copyrightable computer program. Whether any non-faculty contributors qualify as "joint authors" depends partly on whether their respective contributions amount to copyrightable expression and partly on the extent to which courts require an intent to merge these contributions into a unitary whole at the time of creation.¹⁵⁹ Although the "joint works" doctrine has come under considerable pressure lately,¹⁶⁰ the most recent decisions—including cases dealing specifically with computer software—tend to insist on a real intent to merge the respective contributions and to require each putative co-author to have contributed protectible expression and not just ideas.¹⁶¹ If the students or research assistants failed these tests, the prevailing trend

157. See *supra* notes 97-103 and accompanying text.

158. See *supra* text and authorities accompanying notes 113-18. However, the commercial value of termination rights in computer programs remains to be seen in view of their usually short product cycle.

159. See 17 U.S.C. §§ 101 (defining a joint work as "a work prepared by two or more authors with the intention that their contributions be merged into inseparable or interdependent parts of a unitary whole") and 102(a) (1988); *Weissman v. Freeman*, 868 F.2d 1313, 1317-19 (2d Cir.), *cert. denied*, 493 U.S. 883 (1989); *Weinstein v. University of Ill.*, 811 F.2d 1091, 1094-95 (7th Cir. 1987). See also 1 GOLDSTEIN, *supra* note 95, §§ 4.2.1.1 to 4.2.1.2; *supra* note 112 and accompanying text. Students and research assistants working with professors on a project would normally be employees and not independent contractors. See, e.g., *Childress v. Taylor*, 945 F.2d 500, 505-07 (2d Cir. 1991). Nevertheless, if their contributions became creatively significant, claims for joint authorship might lie if the requisite intent to merge them into a unit could be shown.

160. The Supreme Court's decision favoring nonemployee status for most specially commissioned works in *Community for Creative Non-Violence v. Reid*, 490 U.S. 730 (1989), left the question of joint authorship open. This decision was expected to increase the number of claims to joint authorship. See *Harris*, *supra* note 126, at 688-92.

161. See, e.g., *Childress*, 945 F.2d at 505-07; *Ashton-Tate Corp. v. Ross*, 916 F.2d 516, 520-21 (9th Cir. 1990); *S.O.S., Inc. v. Payday, Inc.*, 886 F.2d 1081, 1086-87 (9th Cir. 1989); *M.G.B. Homes, Inc. v. Ameron Homes, Inc.*, 903 F.2d 1486, 1492-93 (11th Cir. 1990). But see *supra* note 112 (citing contrary line of authorities). Those few university policy statements that purport to establish joint copyright ownership between the professor and the university, see *Lape*, *supra* note 136, at 256, may fail of their essential purpose.

would relegate them to the status of employee-creators whose rights, if any, would depend primarily on express or implied contractual agreements.¹⁶²

If the computer program in question is viewed as a joint work, each contributor automatically acquires an undivided estate in the entire work along with the power to license it as he or she deems fit.¹⁶³ Joint authors do owe one another a duty to account for, and to share, the proceeds of their works.¹⁶⁴ This duty, which apparently derives from equitable doctrines under state law,¹⁶⁵ differs from the duties of any joint inventors who may have developed patented features of the same program. The federal patent law expressly exempts joint inventors from any duty to account for, and share, revenues accruing from the exploitation of their patents.¹⁶⁶ Because these two proprietary rules could conceivably apply to aspects of the same computer program-related innovation,¹⁶⁷ the potential conflict between them should not be underestimated.

Further complications arise from the lack of a "double patenting" rule in copyright law,¹⁶⁸ and from codification of "divisible copyrights" in the

162. See *supra* notes 159, 161.

163. See 17 U.S.C. § 201(a) (1988); 1 NIMMER, *supra* note 112, § 6.06[A]; 1 GOLDSTEIN, *supra* note 95, § 4.2.2.

164. See, e.g., *Weissman*, 868 F.2d at 1318; *Weinstein*, 811 F.2d 1091. See also 1 GOLDSTEIN, *supra* note 95, § 4.2.2.1 (citing cases and stressing the need for an individual accounting, lest each co-owner race to exploit the work to the detriment of other co-owners).

165. See, e.g., *Ashton-Tate Corp.*, 916 F.2d at 522.

166. See 35 U.S.C. § 262 (1988); *supra* text and authorities accompanying notes 76-78.

167. Cf. Samuelson, *Benson Revisited*, *supra* note 4, at 1142-48 (discussing concurrent protection of computer programs in copyright and patent laws).

168. "The double patenting doctrine prohibits issue of more than one patent that claims the same or substantially the same invention to the same inventorship entity or to a common assignee of several inventorship entities." The doctrine prevents extension of the limited term of protection and shields potential infringers from multiple patent suits. DONALD S. CHISUM & MICHAEL A. JACOBS, UNDERSTANDING INTELLECTUAL PROPERTY LAW § 2D[4][a] (1992). "Same invention" double patenting occurs if an embodiment of a claim in one patent would literally infringe a claim in another patent. "Obviousness" double patenting occurs if the invention claimed by a second patent is obvious in light of that claimed in the first patent. Double patenting sometimes occurs in design and utility patents that pertain to the same subject matter. *Id.*

Fragmentation of patented inventions is also restricted by 35 U.S.C. § 121 (1988), which allows the examiner to emphasize a single general inventive concept or the "unity of invention." When two or more independent and distinct inventions are claimed in one application, the examiner may restrict the applicant to one of the inventions. See CHISUM & JACOBS, *supra*, § 2D[1][b].

Finally, fragmentation of inventorship in the university context is impeded by 35 U.S.C. § 103 (1988), as amended in 1984. According to Professor Dratler,

This statutory provision [nonobviousness] precludes using as disqualifying prior art under Section 103 any subject matter that qualifies as prior art only under Section 102(f) or Section 102(g) against an invention owned by, or required to be assigned to, the "same person" as that subject matter. Its purpose is to reduce the risk that workers in

1976 Act,¹⁶⁹ both of which facilitate fragmentation of a copyrighted research product into a number of discretely created units or components.¹⁷⁰ For example, even if claims to joint authorship fail for lack of a prior intent to merge,¹⁷¹ persons making separate, protectible contributions to a software development project may each obtain different and separate copyrights to their respective components of the resulting programs and related documentation.¹⁷² By the same token, once a joint work exists, each co-author may prepare his or her own derivative works without the prior permission of other joint authors.¹⁷³ Whether, in such cases, the original co-authors can borrow the derivative-work author's new matter under a theory of fair use remains a doubtful but still unsettled proposition.¹⁷⁴

It follows that when a commercially valuable research product, such as a computer program, consists of multiple creative contributions, and the university's employment contract provides for an assignment of both the faculty member's patent and copyright interests, the university will acquire all those rights that vest in faculty members (or in any other persons covered by the contractual provision), together with any rights that vest in the university itself should the contribution of an author not covered by the agreement to assign be deemed a copyrightable work made for hire.¹⁷⁵ Any transfer of copyright interests to the university

corporate and university research laboratories will be precluded from patenting the results of their team research by virtue of their own co-workers' inventive effort. DRATLER, *supra* note 21, § 2.04[3][b], at 2-103 to 2-104.

169. 17 U.S.C. § 201(d)(2) (1988) (allowing bundle of exclusive rights to be subdivided into segments or packets of any size, and permitting each segment or packet to be transferred and owned separately). See also 17 U.S.C. § 101 (1988) (defining "transfer of copyright ownership"); ABRAMS, *supra* note 125, §§ 4.05[A], 13.02[A].

170. At the limit, two independently created works could be identical and still qualify for copyright protection. See, e.g., *Sheldon v. Metro-Goldwyn Pictures Corp.*, 81 F.2d 49 (2d Cir.), *cert. denied*, 298 U.S. 669 (1936); *Franklin Mint Corp. v. National Wildlife Art Exch.*, 575 F.2d 62 (3d Cir.), *cert. denied*, 439 U.S. 800 (1978). Overlapping claims to the same creative contribution are impermissible in patent law. See *supra* note 168.

171. See *supra* notes 112, 159 and accompanying text.

172. See, e.g., ROBERTSON, *supra* note 51, at 49; *Childress v. Taylor*, 945 F.2d 500, 507 (2d Cir. 1991) (stating that "research assistants may on occasion contribute to an author some protectable expression or merely a sufficiently original selection of factual material as would be entitled to a copyright, yet not be entitled to be regarded as a joint author of the work in which the contributed material appears"). Such a contribution need not be a work made for hire if, for example, it exceeds the scope of any employment agreement that may be in force. See 17 U.S.C. §§ 101 (definition of work made for hire), 201(b) (1988).

173. See, e.g., *Weissmann v. Freeman*, 868 F.2d 1313, 1317-18 (2d Cir.), *cert. denied*, 493 U.S. 883 (1989).

174. 17 U.S.C. § 107 (Supp. 1991) (fair use exception). See, e.g., *Weissman*, 868 F.2d at 1323-27 (stressing, among other factors, the lack of attribution and the disincentives to conducting further derivative research that might result from too facile application of the fair use exception).

175. See *supra* notes 79, 113-22 and accompanying text.

will last for at least thirty-five years;¹⁷⁶ those vesting initially in the university as works made for hire will last for seventy-five years from first publication or 100 years from creation, whichever is shorter.¹⁷⁷ However, if the employment contract provides only for an assignment of patents, that university could find itself owning only the patentable components of a given program but not the copyrightable components of the same program even if it is the product of the same creators. In such a case, those faculty members who created the program would own its copyrightable components, unless the university had moved to align its copyright and patent rules in the field of computer technology.

Conversely, when a university-generated computer program consists of multiple creative contributions but the employment contract does not provide for the transfer of all rights by all contributors (whether or not joint authors), and especially by graduate students and non-faculty research workers, some of these non-faculty contributors could become owners of copyrights in aspects of a program whose commercial exploitation was no longer controlled by its academic creators! To be sure, important student collaborators may have waived or assigned their rights in advance, as some university administrations seem to require, and recent judicial decisions increase the likelihood that their contributions will be treated as employee works for hire rather than as joint works.¹⁷⁸ Even so, a graduate student who made a demonstrably significant contribution to the project might still have grounds for terminating any transfer to the university after thirty-five years¹⁷⁹ on the theory that his contribution exceeded the scope of his employment and that the 1976 Act vested initial ownership of copyright in the *author* of that contribution.¹⁸⁰

Meanwhile, this tangled web of overlapping proprietary interests could hinder short-term efforts to adapt the computer program for industrial applications and compromise the university's overall ability to profit from any intellectual property rights it nominally owns.

176. See *supra* text and authorities accompanying notes 114-15.

177. See *supra* notes 119-20 and accompanying text.

178. See *supra* notes 161-62, 172 and accompanying text. But see *Aymes v. Bonelli*, 980 F.2d 857 (2d Cir. 1992) (linking status of employee-creator of computer program to receipt of employee benefits).

179. See 17 U.S.C. § 203 (1988).

180. See 17 U.S.C. § 201(a) (1988); *Avtec Sys. v. Peiffer*, 805 F. Supp. 1312 (E.D. Va. 1992) (employee's improved version of employer's software, developed outside scope of employment, was not work for hire; derivative work theory not applied; but employee misappropriated employer's trade secrets). See also Hardy, *Economic Understanding*, *supra* note 35, at 257-58; *supra* notes 111, 172. Attempts to characterize creative contributions as works for hire when they do not fall within the pertinent statutory definitions are unenforceable. See 1 GOLDSTEIN, *supra* note 95, § 4.3.2.1.

Adaptations and the Transfer to Industry

Even if the resident faculty originators have duly transferred their rights to the university, proprietary disputes may arise concerning subsequent adaptations and modifications of the research product. For example, each co-owner of copyright can independently prepare his or her own derivative works from a computer program first developed in a university department; and each of the co-owners becomes sole owner of any derivative works prepared without the help of other co-owners.¹⁸¹ Moreover, recent decisions impose no duty on the co-owner who authorizes the making of a derivative work to share revenues from that derivative work with other co-owners of the underlying work who make no new contributions,¹⁸² although equitable principles of state law may entitle these co-owners to an accounting for profits attributable to use of the underlying joint work.¹⁸³

If faculty members retained copyrights covering aspects of a computer program in which the university owned only its patentable components, the copyright owners could develop their own derivative works, based on matter within the scope of their copyrights, so long as these derivative works did not infringe on the university's patents or otherwise violate their fiduciary obligations.¹⁸⁴ If the university's patent rights failed to ripen into an issued and valid patent, faculty members owning copyrighted aspects of the program might still need to exercise care in developing adaptations, lest they interfere with any university-owned rights to

181. See 17 U.S.C. §§ 201(a) (joint authors are co-owners of copyright), 106(2) (giving the "owner of copyright" the exclusive right to prepare or authorize the preparation of derivative works), 103(b) (copyright in derivative work is independent of copyright in the preexisting material), 101 (providing that when "a work is prepared over a period of time, the portion of it that has been fixed at any particular time constitutes the work as of that time, and [when] the work has been prepared in different versions, each version constitutes a separate work") (1988). See also *Ashton-Tate Corp. v. Ross*, 916 F.2d 516, 522-23 (9th Cir. 1990) (stating that "[j]oint authorship in a prior work is insufficient to make one a joint author of a derivative work"); *Weissman v. Freeman*, 868 F.2d 1313, 1318 (2d Cir.), *cert. denied*, 493 U.S. 883 (1989).

182. See, e.g., *Ashton-Tate*, 916 F.2d at 522-23. The Ninth Circuit reasoned that a co-owner does not infringe his own copyright in authorizing a derivative work without the consent of other co-owners, and the making of an authorized derivative work confers no new rights on any owners of the pre-existing works. *Id.*

183. *Ashton-Tate*, 916 F.2d at 522-23. In the U.S. Court of Appeals for the Second Circuit, the intent of the author who created the derivative work may still be relevant to determining ownership of that derivative work even though the other joint author or authors contributed no new matter. See, e.g., *Weissman*, 868 F.2d at 1327 (concurring opinion by Pierce, C.J.). See also *Childress v. Taylor*, 945 F.2d 500 (2d Cir. 1991); Hayes, *supra* note 126, at 10-11.

184. See 17 U.S.C. §§ 103, 106(2) (1988); *supra* note 91; *infra* notes 190 and accompanying text (discussing doctrine of equivalents in patent law), 247 (discussing fiduciary obligations).

unpatented know-how, as will be explained below.¹⁸⁵ Only those universities that had contractually obtained transfers of copyright interests in the program, or that had otherwise contractually regulated the exercise of pertinent exclusive rights, would find themselves in a position to control future adaptations.¹⁸⁶ Any individual author or co-author (whether a faculty member, research assistant or graduate student) not contractually impeded in this fashion would remain free to prepare derivative works and to exploit them commercially, subject only to a duty to account for profits to other joint owners for any use of the underlying work.¹⁸⁷

Because the commercial value of a computer program largely depends on improvements made after an initial breakthrough,¹⁸⁸ the exclusive right to prepare derivative works becomes instrumental in securing an effective transfer to industry. Thus, the university's true capacity to commercialize a computer program might depend partly on its acquisition of the faculty authors' adaptation rights and partly on its ability to limit the number of non-faculty owners of copyright, with a view to controlling the pace at which derivative products are developed and marketed.¹⁸⁹

The Limbo of Noncopyrightable Contributions

Even when the university formally owns a faculty author's derivative work rights, its ability to determine the future development of the program or to control its transfer to industry is limited by a number of practical considerations. The faculty member cannot, of course, autonomously develop the program in ways that render his production the equivalent of any patented components already owned by the university,¹⁹⁰ or that violate the university's exclusive adaptation rights to

185. See *infra* notes 239-52 and accompanying text.

186. If the university could rightfully claim to be an employer-author within 17 U.S.C. § 201(b) (1988), it would own the exclusive adaptation rights. But the status of employer author would only arise with certainty in works prepared expressly for the university's own use. See *supra* notes 132-38 and accompanying text. In the usual case, when the university is not an employer author, it could not readily assert any claim to co-authorship arising from the use of its resources in view of the current judicial tendency to limit co-authorship to inputs of protectible expression. See *supra* notes 159-61.

187. See *supra* notes 163-66 and accompanying text.

188. See, e.g., *Programs as Know-How*, *supra* note 3, at 691 n.276.

189. See, e.g., Dreyfuss, *supra* note 35, at 624-26, 640. Retention by the university of a non-exclusive royalty-free license to use the professor's copyrighted work may simplify some problems. See, e.g., Lape, *supra* note 136, at 261. Faculty reimbursement of the university for use of resources is also an option.

190. See *supra* note 91. See also Henrik D. Parker, *Doctrine of Equivalents Analysis After Wilson Sporting Goods: The Hypothetical Claim Hydra*, 18 AIPLA Q.J. 262 (1990); Adelman & Francione, *supra* note 91.

copyrightable expression embodied in the program.¹⁹¹ Yet, a faculty member who assigns copyrightable expression to the university still retains the right to use any noncopyrightable, unpatented ideas, methods, principles or processes his program contains, as well as any legally unprotectible contributions by third parties, so long as the exercise of this right does not conflict with any rights the university may have in unpatented know-how.¹⁹²

Three federal appellate decisions have significantly expanded the potential scope of noncopyrightable components of computer programs available for use by any professors or staff members who had otherwise assigned the rights in copyrightable expression to their universities.¹⁹³ In the leading decision, *Computer Associates International Inc. v. Altai, Inc.*, the United States Court of Appeals for the Second Circuit disaggregated an allegedly infringed program into a hierarchy of subprograms organized in descending levels of abstraction.¹⁹⁴ The Second Circuit then mandated application of a "successive filtering" test to exclude unprotectible matter at each level of abstraction.¹⁹⁵

191. See 17 U.S.C. §§ 106(2), 501 (1988 & Supp. II 1990); *supra* notes 182-83.

192. See 17 U.S.C. §§ 102(b), 103, 107 (fair use) (1988); 35 U.S.C. § 271 (1988); *Baker v. Selden*, 101 U.S. 99, 103 (1879). Broadly conceived, know-how is the "knowledge of how to organize a certain production in the most efficient and competitively advantageous manner," and it is "essentially a fund of technical knowledge and experience acquired by an enterprise in the use and application of an industrial technique." 3 LADAS, *supra* note 8, at 1617. See also *infra* text accompanying notes 257-68 (discussing ownership of unpatented know-how developed in a university environment).

193. See *Computer Assocs. Int'l v. Altai, Inc.*, 982 F.2d 693 (2d Cir. 1992); *Brown Bag Software v. Symantec Corp.*, 960 F.2d 1465 (9th Cir. 1992); *Plains Cotton Coop. Ass'n. v. Goodpasture Computer Serv.*, 807 F.2d 1256 (5th Cir.), *cert. denied*, 484 U.S. 821 (1987). See also *Lewis Galoob Toys v. Nintendo of Am.*, 964 F.2d 965 (9th Cir. 1992), *amended*, 1992 U.S. App. LEXIS 17680. But see *Whelan Assocs. v. Jaslow Dental Lab.*, 797 F.2d 1222 (3d Cir. 1986), *cert. denied*, 479 U.S. 1031 (1987).

194. *Computer Associates*, 982 F.2d at 706-12. ("Substantial Similarity Test for Computer Program Structure: Abstraction—Filtration—Comparison"). Proving non-literal infringement normally requires a plaintiff to show that the accused infringer had access to the protected work and that the allegedly infringing work contains expressive features that are substantially similar to original expressive features in the protected work. See 2 GOLDSTEIN, *supra* note 95, §§ 7.1.2., 7.3.2.

195. *Computer Assocs.*, 982 F.2d at 706-12. See also *Brown Bag Software*, 960 F.2d at 1475-77 (endorsing "analytical dissection" of computer programs in order to isolate protectible expression); *Atari Games Corp. v. Nintendo of Am.*, 975 F.2d 832, 839-41 (Fed. Cir. 1992) (applying Second Circuit's successive filtering test as consistent with Ninth Circuit's precedent in *Brown Bag Software*). For insight into the "levels of abstraction" concept as used in *Computer Associates*, see Randall Davis, *The Nature of Software and Its Consequences for Establishing and Evaluating Similarity*, 5 SOFTWARE L.J. 299, 310-12, 329 (1992). The successive filtering test adopted in *Computer Assocs.*, 982 F.2d at 706-10, was developed by David Nimmer et al., *A Structured Approach to Analyzing the Substantial Similarity of Computer Software in Copyright Infringement Cases*, 20 ARIZ. ST. L.J. 625, 628-34 (1988) and later incorporated into 3 NIMMER, *supra* note 112, § 13.03[F].

For example, courts following this approach could not premise a finding of non-literal copying on similarities that pertain to sets of modules necessary for efficient operations, to structural architecture bearing on efficiency, or to any technical ideas present in different structural subcomponents of the programs at issue.¹⁹⁶ Also excluded from the calculus of protected expression are elements dictated by external factors, including standard programming techniques, mechanical specifications, compatibility requirements, manufacturers' design standards, and functional demands of the industry being served.¹⁹⁷ A district court decision, influenced by these precedents, has drastically narrowed the scope of protection for user interfaces.¹⁹⁸

Two other federal appellate decisions make it easier for faculty members pursuing their private entrepreneurial interests to continue to reverse-engineer the unprotectible matter in university-generated computer programs even after the university transfers ownership of copyrights in these programs to industry.¹⁹⁹ These cases suggest that, when circumstances unduly restrict an investigator's access to noncopyrightable elements of a computer program, the investigator's right to reverse engineer may even entail decompilation of object code in order to reconstruct undisclosed source code developed either at the university or by industrial licensees.²⁰⁰ Provided that a professor's self-serving use

196. *Computer Assocs.*, 982 F.2d at 706-15. See also *Brown Bag Software*, 960 F.2d at 1475-77 (excluding functional matter wherever located).

197. *Computer Assocs.*, 982 F.2d at 707-10. See also *Brown Bag Software*, 960 F.2d 1465 (affirming decision that excludes functional matter generally, including features or concepts used in myriad computer programs, numerous functions, plus expression that is standard or commonplace in the field); *Plains Cotton*, 807 F.2d 1256 (excluding matter dictated by demands of industry being serviced). But see *Whelan Associates*, 797 F.2d 1222 (identifying purpose of program as "idea" and broadly protecting the structure, sequence and organization implementing it).

198. See *Apple Computer, Inc. v. Microsoft Corp.*, 799 F. Supp. 1006 (N.D. Cal. 1992) (excluding numerous standard or common features of user interface as ideas, or purely functional elements, or indispensable expression, and also excluding overall arrangement of these features in the absence of literal copying). But see *Lotus Dev. Corp. v. Borland Int'l*, 799 F. Supp. 203 (D. Mass. 1992) (broadly protecting even functional elements of user interface); *Gates Rubber Co. v. Bando American, Inc.*, 798 F. Supp. 1499 (D. Colo. 1992).

199. See *Atari Games Corp. v. Nintendo of Am.*, 975 F.2d 832 (Fed. Cir. 1992); *Sega Enters. Ltd. v. Accolade, Inc.*, 977 F.2d 1510 (9th Cir. 1992). Cf. *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141, 159-64 (1989) (stressing competitor's right to reverse engineer unpatented products).

200. See, e.g., *Atari Games*, 975 F.2d at 843 ("When the nature of a work requires intermediate copying to understand the ideas and processes in a copyrighted work, that nature supports a fair use for intermediate copying. Thus, reverse engineering object code to discern the unprotectible ideas in a computer program is a fair use."); *Sega*, 977 F.2d at 1524, 1527-28 (stating that, "[t]o the extent that a work is functional or factual, it may be copied"; and holding that, where disassembly of object code was necessary to understand functional requirements for purposes of securing compatibility, the making of intermediate copies was fair use). See also *Brief Amicus Curiae of Eleven Copyright Law Professors in*

of such unprotectible matter does not constitute misappropriation of trade secrets or a breach of fiduciary obligations,²⁰¹ and that the enterprising faculty member's end product does not otherwise infringe the university's copyright in the initial program (if any),²⁰² he or she would not need to share the proceeds from commercial exploitation of the noncopyrightable components with the proprietary rights holders, absent some enforceable agreement to the contrary.²⁰³

To be sure, any faculty member motivated purely by altruistic notions of public enlightenment rather than by entrepreneurial ambitions could undermine the value of his or her university's intellectual property rights simply by publishing or inopportunistically disclosing the pertinent discoveries,²⁰⁴ unless restrained by specific nondisclosure clauses in the employment agreement or by implicit obligations of confidentiality. In the case of joint works (or joint inventions), questions about the faculty member's implied duty to preserve the common estate could arise, including a duty to keep the work from falling into the public domain; and a similar duty might in theory derive from the fiduciary duties of the

Sega Enterprises, Ltd. v. Accolade, Inc., 33 JURIMETRICS J. 147 (1992). The results in these cases are consistent with, if not mandated by, *Baker v. Selden*, 101 U.S. 99 (1879), which the Supreme Court reaffirmed in *Feist Publications v. Rural Tel. Serv.*, 111 S. Ct. 1282, 1290 (1991). See also *Programs as Know-How*, *supra* note 3, at 693, 693 n.288; Samuelson, *Critique of Lotus*, *supra* note 19, at 324-31; Jessica Litman, *Copyright and Information Policy*, 55 LAW & CONTEMP. PROBS. 185, 196-201 (1992).

201. See e.g. *Computer Assocs.*, 982 F.2d at 715-20; *Avtec Sys. v. Peiffer*, 805 F. Supp. 1312 (E.D. Va. 1992) (holding employee's improved version of employer's software not to be a work made for hire, but finding employee had misappropriated employer's trade secrets); *infra* text and authorities accompanying notes 214-224. For a broader concept of misappropriation, see Leo J. Raskind, *The Misappropriation Doctrine as a Competitive Norm of Intellectual Property Law*, 75 MINN. L. REV. 875 (1991).

202. See *Sega*, 977 F.2d at 1527-28; *Atari Games*, 975 F.2d at 843 (warning that "[f]air use to discern a work's ideas . . . does not justify extensive efforts to profit from replicating protected expression").

203. See also 1 GOLDSTEIN, *supra* note 95, § 4.2.1.2. A professor who exercised his right to reverse engineer the unprotected matter in programs distributed under license from the university might, of course, want to avoid participation in projects that diminished the returns to which he was otherwise entitled by dint of the university's own licenses. When such fears are not a factor, the professor pursuing his or her own interests must avoid any conflict of interests with the university. See, e.g., Joyce Brinton, *Biotechnology Licensing: Issues From the University Perspective*, 16 AIPLA Q. J. 479, 481-83 (1988/89). In addition, he or she must take pains not to breach any express or implied duties of confidentiality arising from the employment relationship itself. See, e.g., *Avtec*, 805 F. Supp. 1312 (finding employee's improved version of employer's software a breach of the employee's fiduciary duties even though it was developed outside the scope of employment); *infra* text accompanying notes 246-47.

204. Cf. *Massachusetts Inst. of Technology v. AB Fortia*, 774 F.2d 1104 (Fed. Cir. 1985) (holding that a research paper explaining cell culture technique, which was presented orally to conference of cell culturists and distributed without restrictions to a number of scientists more than one year before filing date of patents at issue, was novelty-destroying "printed publication" within 35 U.S.C. § 102(b) (1988)).

employment relation.²⁰⁵ But universities that routinely curtail dissemination of research results by contractual agreement are in grave conflict with their academic mission and with the faculty member's own academic freedom, and such attempts could cast doubt on the tax-exempt status of the university enterprise.²⁰⁶ In this regard, universities are well advised to acknowledge expressly that a faculty member's decision to publish research results, should he or she opt to forego a transfer to industry, always trumps any commercial interests that the university intends to exercise.²⁰⁷

Assuming, however, that both the faculty creators and the university authorities aim to commercialize an unpatented computer program, the faculty members' unfettered rights to use noncopyrightable elements of the research product could greatly diminish the value of the university's own intellectual property rights without infringing them and without necessarily violating any contractual agreement. In particular, the academics' newly vindicated rights to reverse-engineer unprotected matter,²⁰⁸ coupled with their unique expertise as creators of the program, make them formidable potential competitors of the university or its industrial licensees. One way to limit this threat requires the university to turn to trade secret law and its attendant contractual constraints, as discussed below.²⁰⁹ Another, less drastic solution is for universities contractually to require faculty members to share the proceeds from commercial exploitation of unpatented, noncopyrightable research results developed with university resources or within the scope of their employment. Some universities have already taken steps to introduce clauses to this effect into their transfer of technology rules in order that the university community as a whole may benefit from the faculty member's successful venture,²¹⁰ irrespective of the university's

205. See 1 GOLDSTEIN, *supra* note 95, §§ 4.2.2.2, 6.1 (discussing the joint owner's duty not to license a joint work in such a way as to destroy its value); *infra* notes 242-47 and accompanying text.

206. See, e.g., Rebecca S. Eisenberg, *Academic Freedom and Academic Values in Sponsored Research*, 66 TEX. L. REV. 1363, 1378-79 (1988) [hereinafter Eisenberg, *Academic Freedom*]; Cornish, *supra* note 79, at 16. See also Nelsen, *supra* note 85, at 365, 372 (stating that M.I.T. does not license disembodied know-how and prefers to keep trade secrets only in conjunction with patent applications, while recognizing exceptions for tangible research property).

207. In the event that outside funding providers require a derogation from this rule, the faculty member should not accept the grant unless he or she can live with the restrictions it carries or can negotiate a more acceptable deal. See Eisenberg, *Academic Freedom*, *supra* note 206, at 1393-98; *infra* note 270 and accompanying text.

208. See *supra* notes 131, 199-203 and accompanying text.

209. See *infra* text accompanying notes 221-36.

210. See, e.g., Vanderbilt University's proposed policy, *supra* note 148. See also Nelsen, *supra* note 85, at 365, 368 (M.I.T. licenses tangible embodiments of know-how, but not disembodied know-how, while recognizing potential conflict with university mission of disseminating knowledge); Cornish, *supra* note 79, at 15-17 (implying that some U.K.

own success in exploiting any intellectual property rights arising from the same research activity.

In any event, close cooperation between the university as proprietary rights owner and faculty creators of a particular computer program seems indispensable to maximizing profits under the best of circumstances. Even then, the interests of university and faculty will not always converge, and conflicts between them could threaten the success of any commercial venture.²¹¹

B. ANCILLARY REGIMES

Even when faculty members and university administration have contractually allocated ownership of any patents and copyrights arising from a computer program-related project to the satisfaction of both sides, they may later discover that the commercially most valuable aspects of the program embody unpatented, noncopyrightable know-how.²¹² Unless their agreement also covers that know-how, the true value of the university's interest may remain uncertain.²¹³ Whatever the contractual relation, moreover, efforts to exploit this know-how call into play certain ancillary legal regimes, mostly sounding in state law, that may conflict directly with the university's mission and with the dissemination of research results.

1. Trade Secrets in the Open Academy

a. General Considerations

Unpatented, noncopyrightable technologies developed in a university environment may qualify for protection under state trade secret laws in the United States²¹⁴ or under the common law of confidential informa-

universities claim rights to unpatented faculty-generated research).

211. See, e.g., Gunzalus, *Considerations in Licensing Spin-off Technology*, 21 J. OF THE SOC. OF RESEARCH ADMINISTRATORS 13-25 (1989). See also *Who Owns the Idea*, OMNI, March 1985, at 35 (discussing well-known program authored in part by a university professor who abandoned the project and the university in the wake of disputed claims to ownership).

212. See, e.g., Davis, *The Nature of Software*, *supra* note 195, at 312-16; Elmer Galbi, *Proposal for New Legislation to Protect Computer Programming*, 17 BULL. COPYRIGHT SOC'Y 280, 281 (1969); *supra* note 192 (definition of know-how); *Programs as Know-How*, *supra* note 3, at 656-62.

213. See *infra* text accompanying notes 242-59.

214. See, e.g., *Kewanee Oil Co. v. Bicron Corp.*, 416 U.S. 470 (1974) (holding that the federal patent law does not preempt state trade secret laws, even when the secret involves patentable subject matter, provided that the secrecy requirement of trade secret law is maintained); 17 U.S.C. § 301 (Supp. III 1991) (effect of which is not to preempt state trade secret laws when the subject matter is not fixed in a tangible medium of expression, is

tion in both the United States²¹⁵ and the United Kingdom.²¹⁶ Trade secret laws generally cover "any formula, pattern, device or compilation of information"²¹⁷ that confers a business advantage over competitors, so long as it is sufficiently definite and not commonly known in the trade, and so long as reasonable precautions are taken to preserve its secrecy.²¹⁸ The best known definition of trade secret also lays emphasis on "independent economic value, actual or potential" that derives from actual or legal secrecy.²¹⁹ While applied university research always has potential economic value, at least one author contends that this criterion "might not be wide enough to cover information relating to pure

barred from copyright protection by 17 U.S.C. § 102(b) as an idea, procedure or process, or when an action to protect trade secrets requires an element not required to prove copyright infringement, such as a breach of confidence). *See also* *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141 (1989) (reconfirming *Kewanee* but preempting state statute that prohibits use of direct molding process to copy products); 2 ROGER M. MILGRIM, *MILGRIM ON TRADE SECRETS* § 7.08[2][f] (rev. ed. 1992).

215. *See, e.g., Roboserve, Ltd. v. Tom's Foods, Inc.*, 940 F.2d 1441, 1453-56 (11th Cir. 1991) (preemption of trade secret claim by federal patent law, which gave a right to reverse-engineer on these facts, did not necessarily preclude liability for breach of confidence based on expectations of the parties); DRATLER, *supra* note 21, § 4.05[1][b], [c] (discussing confidential relationships other than that of employment). Arguably, so long as a trade secret holder must take reasonable precautions to preserve secrecy and cannot maintain a legal action against third parties absent a showing of some wrongful conduct, both the "tort" and "property" theories of trade secret protection are but two sides of the same coin, different in emphasis only. *See Rockwell Graphic Sys. v. DEV Indus.*, 925 F.2d 174, 178-79 (7th Cir. 1991) (Posner, C.J.).

216. *See, e.g., CORNISH, supra* note 57, at 215-19; FRANCIS GURRY, *BREACH OF CONFIDENCE* 90-97 (1989). United Kingdom law does not distinguish among types of information that may be protected against breach of confidence, and it covers some matters that would fall under rights of privacy in the U.S. At the same time, courts in the U.K. may use contract law, employment law, company law and tort law to supplement the law of confidential information. *See, e.g., ROBERTSON, supra* note 51, at 87-89. Nevertheless, recent trends in the case law do appear to treat trade secrets and personal confidences differently. *See, e.g., ALLISON COLEMAN, THE LEGAL PROTECTION OF TRADE SECRETS* 8-9 (1992). For the situation in Canada, see INSTITUTE OF LAW RESEARCH AND REFORM, EDMONTON, ALBERTA AND A FEDERAL PROVINCIAL WORKING PARTY, *TRADE SECRETS* (Report No. 46, July 1986).

217. *RESTATEMENT OF TORTS* § 757 cmt. b (1939). *Cf. GURRY, supra* note 216, at 90-97 (discussing technical secrets and business secrets); *COLEMAN, supra* note 216, at 4-28 (comparing U.S. and U.K. definitions).

218. *See, e.g., RESTATEMENT OF TORTS* § 757 cmt. b (1939); *UNIFORM TRADE SECRETS ACT*, 14 ULA § 1(4) (1985) [hereinafter *UTSA*] (defining a trade secret as "information, including a formula, pattern, compilation, program, device, method, technique, or process, that: (i) derives independent economic value, actual or potential, from not being generally known to, and not being readily ascertainable by proper means by other persons who can obtain economic value from its disclosure or use, and (ii) is the subject of efforts that are reasonable under the circumstances to maintain its secrecy"); *Rockwell Graphic Sys. v. DEV Indus.*, 925 F.2d 174 (7th Cir. 1991).

219. *UTSA*, § 1(4), quoted in full *supra* note 218.

research," which could narrow the scope of protection against some forms of misappropriation.²²⁰

Assuming that much university research could fit within the operative definitions of trade secret, such eligibility confers no exclusive rights to make, use, sell or reproduce any given discovery in the manner of patents or other statutory intellectual property rights.²²¹ Rather, third-party acquisition of secret knowledge becomes actionable only when obtained by improper means, that is to say, in ways that are excluded by private agreement or that violate a confidential relationship or that otherwise offend public policy.²²² Trade secrets that are voluntarily revealed, insufficiently guarded or reverse-engineered by proper means lose all protection and become subject to free competition.²²³ Trade secret law thus provides some incentive to develop incremental innovation that falls short of the nonobviousness standard of patent law, while it simultaneously discourages industrial espionage, unethical behavior and corruption.²²⁴

220. COLEMAN, *supra* note 216, at 23.

221. See, e.g., *Kewanee Oil Co. v. Bicron Corp.*, 416 U.S. 470, 476, 490 (1974); DRATLER, *supra* note 21, § 4.04 ("[s]trictly speaking, a trade secret owner has no 'exclusive' rights in the secret"); Michael J. Hutter, *Protecting Trade Secrets: Legal Theories*, in DAVID A. ANDERSON & MELVIN F. JAGER, *PROTECTING TRADE SECRETS* 1989 20 (PLI ed. 1989). See also *Rockwell Graphic Sys. v. DEV Indus.*, 925 F.2d 174, 179 (7th Cir. 1991) (suggesting that a theory that gave the trade secret holder a property right valid against the world would be preempted by the federal patent statute).

222. See, e.g., DRATLER, *supra* note 21, § 4.04[2]; COLEMAN, *supra* note 216, at 25.

223. See, e.g., UTSA, *supra* note 218, § 1(2) (defining misappropriation as "(i) acquisition of a trade secret of another by a person who knows or has reason to know that the trade secret was acquired by improper means; or (ii) disclosure or use of a trade secret of another without express or implied consent by a person who (A) used improper means to acquire knowledge of the trade secret; or (B) at the time of disclosure or use, knew or had reason to know that his knowledge of the trade secret" was derived from persons or acquired in circumstances characterized by improper means. The Model Act further defines improper means to include "theft, bribery, misrepresentation, breach or inducement of a breach of a duty to maintain secrecy, or espionage through electronic or other means"). See also *RESTATEMENT OF TORTS* § 757 cmt. a (1939). Compare *Chicago Lock Co. v. Fanberg*, 676 F.2d 400 (9th Cir. 1982) (finding no misappropriation of trade secrets by locksmiths who reverse-engineered key codes from locks sold by plaintiff) with *Tabor v. Hoffman*, 23 N.E. 12 (N.Y. 1889) (finding misappropriation of trade secret when defendant copied secret plans for rotary pump even though the pump itself had been placed on the market).

224. See, e.g., 3 LADAS, *supra* note 8, at 1617; David D. Friedman, William M. Landes and Richard A. Posner, *Some Economics of Trade Secret Law*, 5 J. EC PERSP. 61, 70 (1991); Edmund W. Kitch, *The Law and Economics of Rights in Valuable Information*, 9 J. LEGAL STUD. 683-93, 699-701, 711-23 (1980); Korn, *supra* note 10, at 191, 218-19. See also Alois Troller, *The Legal Protection of Know-How: General Report*, in *THE PROTECTION OF KNOW-HOW IN 13 COUNTRIES* 149, 151-52, 156-57 (H. Cohen Jehoram ed. 1971).

In principle, any computer technology is protectible as a trade secret, irrespective of its status as patentable or copyrightable subject matter.²²⁵ For example, producers rarely disclose the source codes underlying publicly distributed computer software. They also routinely use contractual models that leverage copyright and trade secret laws to prevent third parties from reconstructing their own version of the undisclosed source code from decompiled object code.²²⁶ As the federal judiciary narrows the scope of copyright protection for computer programs by aggressive application of the subject matter exclusions set out in § 102(b) of the 1976 Act,²²⁷ patent and trade secret laws may afford the only available means of repressing non-literal copying.²²⁸

Whether trade secret law can effectively protect information that has been embodied in publicly distributed material supports remains to be seen. Historically, the sale or circulation of goods embodying valuable information tended to forfeit trade secret protection on the theory that the secret matter was fathomable upon scrutiny or inspection.²²⁹ To the extent that copyright law inhibits decompilation of technical solutions embodied in publicly distributed object code, third-party rights to reverse-engineer a programmer's undisclosed ideas conflict with the author's exclusive reproduction rights.²³⁰ When faced with this conflict,

225. See, e.g., *Integrated Cash Management Serv. v. Digital Transactions*, 920 F.2d 171 (2d Cir. 1990); *Q-Co. Indus., Inc. v. Hoffman*, 625 F. Supp. 608, 617 (S.D.N.Y. 1985); *Bender*, *supra* note 51, at 921, 924, 958. But see *infra* note 233 and accompanying text (concerning pre-empted state law).

226. See, e.g., David A. Rice, *Licensing the Use of Computer Program Copies and the Copyright Act First Sale Doctrine*, 30 JURIMETRICS J. 157 (1990); David A. Rice, *Trade Secret Clauses in Shrink-Wrap Licenses*, 2 THE COMPUTER LAW. (#2) 17 (Feb. 1985); Rice, *Reverse Engineering*, *supra* note 52, at 552-67.

227. 17 U.S.C. § 102(b) (1988). See *supra* notes 131, 193-98 and accompanying text.

228. See, e.g., *Computer Assocs. Int'l v. Altai, Inc.*, 982 F.2d 693, 715-20 (2d Cir. 1992); *Integrated Cash Management Servs. v. Digital Transactions*, 920 F.2d 171 (2d Cir. 1991); *Plains Cotton Coop. Ass'n v. Goodpasture Computer Serv.*, 807 F.2d 1256 (5th Cir.), *cert. denied*, 484 U.S. 821 (1987); *Q-Co. Indus. v. Hoffman*, 625 F. Supp. 608, 617 (S.D.N.Y. 1985). See generally Roger M. Milgrim, *Trade Secret Law to Protect Computer Programs*, paper presented to the Conference on Significant Developments in Computer Law 1991, University of Dayton School of Law, Dayton, Ohio, June 7, 1991 [hereinafter *Milgrim, Computer Programs*].

229. See, e.g., *Roboserve, Ltd. v. Tom's Foods Inc.*, 940 F.2d 1441, 1455 (11th Cir. 1991) (stating that once the defendant had purchased one of plaintiff's machines, "trade secret law could not prevent . . . [the defendant] from dissecting that machine for any reason, or from shipping it . . . [to a third-party] for dissection"). See generally 1 MILGRIM, *supra* note 214, § 2.05[2] (citing other authorities). But see *id.* § 2.05[3] (discussing exceptions to the general principle).

230. See, e.g., 17 U.S.C. §§ 106(1)-(2), 117 (Supp. III 1991); *S.O.S., Inc. v. Payday, Inc.*, 886 F.2d 1081 (9th Cir. 1989) (licensee infringes licensor's copyright when it exceeds the scope of its license by copying and preparing modified version of licensor's program); *Sega Enters. v. Accolade, Inc.*, 785 F. Supp. 1392 (N.D. Cal.), *rev'd*, 977 F.2d 1510 (9th Cir. 1992). Legal barriers to decompilation also discourage the development of functionally equivalent

however, the federal appellate courts have lately excused the making of intermediate copies for purposes of analyzing noncopyrightable ideas as a fair use.²³¹ Producers who attempt to circumvent these decisions contractually run the risk that courts will hold restrictions on the reverse-engineering of noncopyrightable program components unenforceable on a variety of grounds, while state enforcement of such restrictions could also raise serious questions of preemption.²³² Because computer programs are expressed in writings, moreover, courts can also preempt state trade secret actions by reducing the alleged misappropriation to a violation of the exclusive reproduction rights that copyright law provides.²³³

The very nature of computer programs thus foreshadows certain practical limitations on the use of trade secret law, which investors ignore at their peril. Apart from the inherent risk of lawful reverse-engineering, for example, the measures necessary to maintain legal secrecy can become costly and burdensome over time, and at the limit, they can hinder efficient exploitation of the innovation even by authorized third parties.²³⁴ Moreover, injunctive relief in domestic law is usually limited in duration to the estimated period required for reverse-engineering (i.e., the lead-time period that was neutralized by a wrongful

products that depend on interoperability with existing systems. See, e.g., *Lotus Dev. Corp. v. Borland, Int'l*, 799 F. Supp. 203 (D. Mass. 1992); *Lotus Dev. Corp. v. Paperback Software Int'l*, 740 F. Supp. 37 (D. Mass. 1990). See also Samuelson, *Critique of Lotus*, *supra* note 19.

231. See *supra* notes 199-203 and accompanying text.

232. See, e.g., *Vault Corp. v. Quaid Software*, 847 F.2d 255, 270 (5th Cir. 1988); Rice, *Reverse Engineering*, *supra* note 52, at 567, 577-628; Rice, *Licensing the Use of Computer Program Copies and the Copyright Act First Sale Doctrine*, *supra* note 226. But see Robert C. Scheinfeld & Gary M. Butter, *Using Trade Secret Law to Protect Computer Software*, 17 RUTGERS COMPUTER & TECH. L.J. 381, 390-94 (1991) (concluding that use of a properly worded shrink-wrap license coupled with mass distribution of product in object code "will likely (and should) serve to keep the trade secret in the source code alive").

233. See 17 U.S.C. § 301 (1988); *Vault*, 847 F.2d 255; *Foresight Resources Corp. v. Pfortmiller*, 719 F. Supp. 1006 (D. Kan. 1989). See also *Computer Assocs.*, 982 F.2d at 717-20 (finding extra legal elements to avoid preemption); Stephen J. Davidson, *What to Expect in Litigating Trade Secret and Reverse Engineering Cases*, 2 J. PROPRIETARY RTS. 7, 9, 13 (1990) (stating that "the extent to which federal copyright laws may preempt state trade secret claims with respect to copyrightable subject matter is yet to be determined").

234. See, e.g., *Rockwell Graphic Sys. v. DEV. Indus.*, 925 F.2d 174, 179-80 (7th Cir. 1991) (stating that the more the trade secret owner spends on preventing disclosure of the secret, the more he demonstrates that it has real value worthy of legal protection; but recognizing that the more he spends, the higher his costs, and that restrictions on access may impair efficiency of operations). See also Bender, *supra* note 51, at 923 (stressing the difficulty third parties encounter in trying to create compatible programs when trade secret law applies).

taking of the secret),²³⁵ while the absence of international treaties establishing extra-territorial recognition of trade secrets renders international protection inherently weak and uncertain.²³⁶

b. Ownership of the Undisclosed Research Product

All of the difficulties inherent in using trade secret law to protect computer program-related technology are compounded when that technology is developed in a university environment. For example, the simplest defense to an action alleging misappropriation of trade secrets is that the information had become public knowledge.²³⁷ If the academic investigators who developed commercially valuable information either voluntarily disclosed it to others who were under no obligation to protect its confidentiality or otherwise publicly disseminated their findings, they would normally have forfeited any proprietary rights that trade secret law provides. Given the academic mission to disseminate research results and the extent to which both internal promotions and external reputation depend on publications, preserving trade secrets in an open university poses practical and ethical problems of considerable magnitude.²³⁸

Assuming that academic investigators eager to commercialize a product of university research, such as a computer program, do accept the burdens of preserving actual and legal secrecy, all the thorny questions of ownership previously examined with regard to patents and copyrights must be carefully reevaluated. Absent a clause in the university's employment contract explicitly allocating the relevant

235. See, e.g., *Integrated Cash Management Servs. v. Digital Transactions*, 920 F.2d 171, 174-75 (2d Cir. 1990) (prohibiting former employees from developing programs similar to those of employer for period of six months only; but permanently enjoining use of programs developed by former employees already in existence at time initial injunction was granted); see also DRATLER, *supra* note 21, § 4.04[7][a].

236. See, e.g., DRATLER, *supra* note 21, § 4.07[1]; Bender, *supra* note 51, at 924. See also Reichman, *GATT Connection*, *supra* note 17, at 747, 758-61, 870-71, 876-78, 884-86 (discussing proposed international minimum standards for the protection of trade secrets and the prospects for strengthening international unfair competition law under Article 10bis of the Paris Convention.)

237. See, e.g., *Ruckelshaus v. Monsanto Co.*, 467 U.S. 986, 1002 (1984). The party claiming trade secret protection has the burden of showing that the data in question qualify as trade secrets in this respect. See, e.g., *Agricultural Labor Relations Bd. v. Richard A. Glass Co.*, 175 Cal. App. 3d 703, 715 (1985); *Imi-Tech Corp. v. Gagliani*, 691 F. Supp. 214, 221 (S.D. Ca. 1986) (stressing lack of knowledge of the trade secrets in the literature and the trade).

238. See, e.g., Alan H. Goldman, *Ethical Issues in Proprietary Restrictions on Research Results*, in *OWNING SCIENTIFIC INFORMATION*, *supra* note 70, at 69, 79-80; Leonard G. Boonin, *The University, Scientific Research, and the Ownership of Knowledge*, in *OWNING SCIENTIFIC INFORMATION*, *supra* note 70, at 253, 266. See also Eisenberg, *Academic Freedom*, *supra* note 206.

proprietary rights to it, however, the results of this evaluation in particular cases will prove hard to predict with any degree of accuracy. Uncertainties stem partly from the lack of any statutory guidance in allocating proprietary rights to tangible embodiments of know-how²³⁹ and partly from doubts about the soundness of applying common law precedents concerning the ownership of industrial know-how to proprietary disputes likely to arise in an academic environment.²⁴⁰ Further uncertainties arise from unresolved tensions in the case law between the need to stimulate innovation by allocating ownership to the party investing money and resources in the development of advanced technical know-how, and the need to acknowledge that the innovation at issue may be largely the product of an employee's own initiative, ingenuity and skill.²⁴¹

By and large, courts adjudicating disputes about proprietary rights to unpatented innovation under state trade secret laws appear increasingly prone to favor industrial employers over employees.²⁴² Unlike the federal copyright law, which automatically vests ownership of eligible works in authors (except works made for hire),²⁴³ the state trade secret laws—in the absence of enforceable agreements to the contrary²⁴⁴—are often judicially interpreted to attribute proprietary rights to the party that expended time, money and effort in procuring the valuable information.²⁴⁵ The calculus of rights is further complicated by the fact that legal protection of commercially valuable information has deeper roots in tort law than in either property or intellectual property laws.²⁴⁶ Tort law often imposes a burden of confidentiality arising out of certain

239. UTSA, *supra* note 218, makes no provision for the allocation of proprietary rights.

240. See *infra* text accompanying notes 257-58.

241. See DRATLER, *supra* note 21, § 4.05[1][a]. For a profound meditation on the extent to which investment as such should generate a proprietary stake in information, see Gordon, *supra* note 6.

242. See, e.g., DRATLER, *supra* note 21, § 4.05[1][a] (stating that, because of the employees' "generally-accepted duty" to maintain the employer's confidences and to preserve the employer's trade secrets, "misappropriation is often a foregone conclusion in trade secret cases involving employees once the existence and unauthorized use of a trade secret has been established").

243. See *supra* text and authorities accompanying notes 109-12, 119-22.

244. See *supra* note 81 and accompanying text (discussing "employee invention" laws recently adopted in several states, which limit the enforcement of employment contracts requiring employees to assign rights in certain inventions to their employers).

245. See, e.g., *Integrated Cash Management Servs. v. Digital Transactions*, 920 F.2d 171, 174 (2d Cir. 1990) (stressing employer's "years of research" and large investment in Research and Development); *Standard Parts Co. v. Peck*, 264 U.S. 52 (1924); 2 MELVIN F. JAGER, *TRADE SECRETS LAW* § 8.01[1] (rev. ed. 1992); *infra* notes 249-52, 266-68 and accompanying text.

246. See, e.g., *Rockwell Graphic Sys. v. DEV Indus.*, 925 F.2d 174, 178-89 (7th Cir. 1991); DRATLER, *supra* note 21, §§ 4.04[6], 4.05[1]. See also COLEMAN, *supra* note 46, at 29-49.

relationships, notably that of employment, that is more restrictive in effect than rights derived from contractual agreements alone or from so-called "property" rights loosely attributed to capital investors.²⁴⁷

Apart from certain qualifications preserving the employee's ability to use his or her skill and knowledge on other jobs,²⁴⁸ the employer who hired an employee to develop new ideas or inventions will normally own that part of the employee's output which qualifies for trade secret protection, and the same applies to independent contractors.²⁴⁹ In the United Kingdom, explicit "ownership" issues as such were less likely to surface in the past because the prevalent legal theory regulating the employee's duties sounded in implied contract law rather than in property law.²⁵⁰ Nevertheless, assuming the valuable information at issue rises to the level of a true trade secret²⁵¹ and is not just general skill or knowledge, the fiduciary duties implied from the employment relation will, in principle, prevent both British and American employees from exploiting that information to their own competitive advantage even in the absence of a contractual obligation to this effect.²⁵²

247. See, e.g., *Roboserve, Ltd. v. Tom's Foods, Inc.*, 940 F.2d 1441, 1454-56 (11th Cir. 1991) (rejecting plaintiff's claim for misappropriation of trade secrets because public distribution of product opened it to reverse-engineering; but sustaining jury's breach of confidence finding "because an item may be considered confidential in the context of a business relationship without rising to the level of a trade secret"); *Q-Co. Indus., Inc. v. Hoffman*, 625 F. Supp. 608, 611 (S.D.N.Y. 1985) (holding employee bound by confidential relationship to preserve secrecy of software program despite lack of formal employment contract, confidentiality agreement or agreement not to compete).

248. See, e.g., *Plains Cotton Coop. Ass'n v. Goodpasture Computer Serv.*, 807 F.2d 1256, 1263-64 (5th Cir.) *cert. denied*, 484 U.S. 821 (1987); *Structural Dynamics Research Corp. v. Engineering Mechanics Research Corp.*, 401 F. Supp. 1102, 1111 (E.D. Mich. 1975); *Wexler v. Greenberg*, 160 A.2d 430 (Pa. S.Ct. 1960); *infra* notes 258-61 and accompanying text.

249. See *supra* notes 245, 247; *Hutter*, *supra* note 221, at 20. See also MILGRIM, *supra* note 214, § 5.02[4]. But see *Structural Dynamics*, 401 F. Supp. at 1111-12; *Wexler*, 160 A.2d 430 (controversial decision favoring employee's right to use or disclose trade secrets he developed); DRATLER, *supra* note 21, § 4.05[1][a] (criticizing under-emphasis on employee's creative contributions).

250. See, e.g., CORNISH, *supra* note 57, at 218-19. See also GURRY, *supra* note 216, at 177-205. A more tort-like approach to trade secret protection, however, is now under discussion in the U.K. See, e.g., COLEMAN, *supra* note 216, at 15-18.

251. See, e.g., Milgrim, *Computer Programs*, *supra* note 228, at 3-8 to 3-9 (stating that "[r]elative secrecy (i.e., not generally known in trade), not patentable novelty, is all that is required for protection"); *supra* notes 218-20 and accompanying text.

252. See, e.g., *Avtec Sys. v. Peiffer*, 805 F. Supp. 1312 (E.D. Va. 1992) (holding that employee who improved employer's software on own time was not creator of work made for hire, but finding that employee nonetheless misappropriated employer's trade secrets and breached fiduciary duties); *supra* notes 245, 247. See generally Milgrim, *Computer Programs*, *supra* note 228, at 3-18 (stating that courts uniformly recognize a confidential relation between employer and employee that precludes the latter from disclosing the former's trade secrets in furtherance of post-employment duties). Other American authorities seem less convinced, however, see *supra* notes 248-49, and some suggest that

How these tensions will play out in the context of university research remains to be seen. Those universities seeking to develop a comprehensive policy concerning the transfer of technology to industry may logically bring the ownership of tangible embodiments of unpatented research results within the framework of their overall contractual dispositions.²⁵³ In such cases, the basic employment contract would probably allocate proprietary rights in tangible embodiments of applied scientific know-how to the university if these were developed with university facilities and resources, or if the research activity in question fell within the investigators' scope of employment.²⁵⁴ A division of the royalties might or might not track the university's standard schedule applicable to patented discoveries.²⁵⁵ Some universities might nonetheless prefer to allocate ownership of tangible research results to the faculty members who performed the work, in exchange for a percentage of the royalties, even if this meant treating faculty members who generated unpatentable information more favorably than those who qualified as statutory inventors.²⁵⁶

the employer's legal rights vary with the jurisdiction and may be hard to enforce in any jurisdiction. See, e.g., 2 ROSENBERG, *supra* note 25, § 11.09 (who argues that employers should obtain only a "shop right" if the employee developed the trade secret). For British authorities supporting the proposition set out in the text, see CORNISH, *supra* note 57, at 228-29; ROBERTSON, *supra* note 51, at 89-95; COLEMAN, *supra* note 216, at 54-56. But see *Faccenda Chicken Ltd. v. Fowler*, [1985] 1 All E.R. 724 (Eng.) (controversial appellate decision significantly relaxing the constraints on the employee after termination of the employment relation and in the absence of valid contractual restrictions); COLEMAN, *supra* note 216, at 61-64 (noting that U.K. law leans less heavily in favor of independent contractors than employees).

253. See *supra* notes 147-56 and accompanying text (cases of Stanford and Vanderbilt Universities); Nelsen, *supra* note 85, at 365, 368 (case of M.I.T.).

254. See *supra* notes 147-58 and accompanying text (discussing interface with copyright law). At Stanford, the university owns unpatented tangible research products, as suggested in the text, even though it declines to take ownership of patents. See *supra* note 79. Under the new policy pending implementation at Vanderbilt, *supra* note 148, patented discoveries and unpatented embodiments of applied scientific know-how would be handled in a similar fashion; the ownership of any copyright interests affecting the technological, rather than the scholarly product, would receive similar treatment to the extent the law permits.

255. Without need to file patent applications, the university's legal costs might be lower. The ability to transfer unpatented know-how to industry without further direct inputs by the responsible faculty members is, however, uncertain, as is the relation between the faculty members' original contribution and their research roles at the university, including any assessment of the use made of university resources. In such cases, it seems preferable to negotiate in good faith within a predetermined range of variables concerning the division of royalties rather than to apply the fixed percentages usually established for patented discoveries. A detailed analysis of issues concerning the distribution of royalties is beyond the scope of this article.

256. See *supra* notes 149-52 and accompanying text (discussing views of Professor Cornish). This model bears affinities with the treatment of literary and artistic works in copyright law more than with the industrial property model discussed earlier.

If the university's employment contract fails to cover this subject, the attribution of rights to tangible embodiments of unpatented, noncopyrightable research results will remain speculative indeed, and dispute resolution may be influenced to a greater degree by the fiduciary duties that tort law imposes on employees in general.²⁵⁷ In the days when universities did not routinely commercialize their research product, patented or not, analogies between the implied duties of industrial employees and those of academicians might have seemed far-fetched and even socially harmful to the extent they indirectly discouraged a transfer to industry.²⁵⁸ Today, however, the universities' avowed interests in commercializing their research results could incline courts to treat academic producers of valuable information more like other industrial employees in the absence of specific contractual dispositions. In that event, any tangible research products would presumptively belong to the university, and the academics who conducted the research might find themselves laboring under a duty to clarify what they owned before attempting to exploit the products of their efforts externally.²⁵⁹

A proprietary bias favoring university ownership or control of faculty-developed know-how embodied in, say, a computer program-related innovation could be cut back if courts sustained some legal exception

257. See *supra* notes 246-47, 252 and accompanying text.

258. Cf. Chew, *supra* note 24, at 285-86.

259. Cf. *Speck v. North Carolina Dairy Found.*, 319 S.E.2d 139 (N.C. 1984) (secret process stemming from professor's research on acidophilous milk belonged to the university absent a written contract by the university assigning its rights to the professor); *State v. Neal*, 12 So. 2d 590 (Fla.), *cert. denied*, 320 U.S. 783 (1943) (employee of Everglades Experiment Station assigned to direct a project to research and develop the use of dried citrus waste as livestock feed and who initially attempted to apply for a patent in the name of the Experiment Station had duty to assign the patent to his employer even in the absence of an express contractual provision requiring assignment). *But cf.* *Plains Cotton Coop. Ass'n v. Goodpasture Computer Serv.*, 807 F.2d 1256, 1262-64 (5th Cir.), *cert. denied*, 484 U.S. 821 (1987) (stressing that, where the employee's initiative brings the secret innovation into being, the employee's fiduciary duties are relaxed because he "may... have an interest in the subject matter at least equal to that of his employer" and also because he retains the right to use his knowledge as part of his skills and experience); *State Bd. of Educ. v. Bourne*, 7 So. 2d 838 (Fla. 1942) (employee of Everglades Experiment Station, hired as plant pathologist and member of team attempting to develop new strains of sugar cane, held entitled to rights in a new strain that he developed because the nature of his employment did not specifically contemplate the development of a new strain, and his employment contract did not show "by express terms or unequivocal inference" that he was hired to invent). See also, Christopher G. Browning, Jr., Note, *The Souring of Sweet Acidophilus Milk: Speck v. North Carolina Dairy Foundation and the Rights of University Faculty to Their Inventive Ideas*, 63 N.C.L. REV. 1248 (1985) (criticizing the holding in *Speck*).

In the absence of an employment contract covering tangible research results, it could also be argued that no confidential obligations were violated because the university had not reserved its proprietary rights nor indicated that it regarded research results as secret. See *infra* text accompanying notes 260-64.

comparable to the "teacher's exception" in copyright law.²⁶⁰ One possibility in domestic law is for professors to compare their status to that of generally inventive employees under patent law, who are simply hired to pursue their creative instincts, or to non-inventive employees from whom no inventive activity is expected.²⁶¹ To make their case, university professors would need to emphasize the high level of skill and knowledge they brought to the job; the extent to which they developed the relevant know-how on their own initiative; and the relatively insignificant use of university resources or the lack of participation by other university personnel.²⁶² In some jurisdictions, professors might contend that the specific innovation at issue fell outside the scope of their contractually defined employment duties, and that, on analogy to patent law, the employer should at most obtain a "shop right" to use the innovative know-how if the employer's resources or facilities were used.²⁶³ Above all, the professors would urge courts to balance the expectations arising from employment at a research university against the interests of individual faculty members, lest they discourage technological creativity and freedom of expression by stripping away the innovative academic's property rights without sufficient justification.²⁶⁴

260. See *supra* text and authorities accompanying notes 132-37.

261. See, e.g., 6 CHISUM, *supra* note 22, § 22.03[2] (suggesting that when employees are hired merely to "do research" or to "improve" or "design" products, without more, it does not make the resulting inventions the employer's property because the task assigned was too broad); Hovell, *supra* note 67, at 90-100 (noting the uncertainty in this area of law, which results from the courts' attempts to balance the rights of employees and employers in individual cases and from the all-or-nothing nature of the decision as to the duty to assign the invention to the employer); *supra* note 85. See also Gullette, *supra* note 85, at 733. But see 1 LADAS, *supra* note 8, at 324-25 (noting worldwide tendency to regard "service inventions" made as a result of research or inventive activity, when a primary task of the employee, as property of employer; but acknowledging controversy as to whether employer takes title directly or as a result of some legal transaction with employee); 1 MILGRIM, *supra* note 214, § 5.02[4][b] (concluding that an employee generically hired to "invent" has a duty to assign inventions to his employer even when the employer does not designate the specific item or field in which the employee is to work). See also RESTATEMENT (SECOND) OF AGENCY § 397 cmt. a (1957) (concluding that if "one is employed to do experimental work for inventive purposes . . . [then] patentable ideas arrived at or through the experimentation" belong to the employer, but claiming "if one is employed merely to do work in a particular line in which he is an expert, there is no inference that inventions which he makes while so working belong to the employer").

262. Cf. *United States v. Dubilier Condenser Corp.*, 289 U.S. 178, *amended*, 289 U.S. 706 (1933); *University Patents, Inc. v. Kligman*, 762 F. Supp. 1212 (E. D. Pa. 1991); cf. also Davidson, *supra* note 233, at 11-12; Chew, *supra* note 24, at 266-71.

263. See, e.g., *Avtec Sys. v. Peiffer*, 805 F. Supp. 1312 (E. D. Va. 1992) (recognizing that, where employee improved employer's software on own time, employer obtained shop rights in the program for use and demonstration purposes, on analogy to patent law; but omitting to consider employer's derivative work rights in copyright law); 2 ROSENBERG, *supra* note 25, § 11.09; *supra* notes 68, 86.

264. See, e.g., 6 CHISUM, *supra* note 22, § 22.03[2]; Hovell, *supra* note 67, at 90-100; Chew, *supra* note 24, at 304-10.

These exceptions are fairly well established in patent law, and to the extent that courts were to accept them by analogy in regard to unpatented research results, they could limit a university's hold on its innovative professors.²⁶⁵ In practice, however, decisions concerning unpatented innovation tend to differ from those concerning patents because of the added emphasis in trade secret law on duties arising from the confidential nature of the employment relationship,²⁶⁶ and on the need to encourage employers to invest in the development of products that are legally susceptible to reverse-engineering by proper means.²⁶⁷ Courts sensitive to these concerns may stress that a professor's research takes place at the university, with the use of university resources, and that a professor's salary compensates both teaching *and* research in the relevant disciplines. For example, the Supreme Court of North Carolina found a university under no obligation to share the royalties from applications of a professor's research on acidophilus milk because the research had been conducted with university resources and because the professor's innovative activity fell within the scope of his employment.²⁶⁸

265. For example, if the "noninventive" professor had disclosed his or her trade secret to the university and the latter had used it with permission, or if the same professor had merely used university resources in developing the invention, a shop right analogous to that of patent law could logically facilitate further research without impeding the professor from exploiting his research results. *See, e.g.*, 1 MILGRIM, *supra* note 214, § 5.02[4][c]; Hutter, *supra* note 221, at 20; *supra* note 263. By the same token, if no disclosure to the university had occurred or if the university had not used the discovery with the professor's consent, that discovery might not even qualify as a trade secret because no one had used it in the course of business nor would anyone have obtained a competitive advantage from it. *See, e.g.*, 1 MILGRIM, *supra* note 214, § 5.02[4][c] (suggesting that the rules relating to idea submission might apply, particularly when the discovery is not sufficiently "concretized"); Milgrim, *Computer Programs*, *supra* note 228, at 3-7 to 3-8 (discussing the pros and cons of claiming trade secret protection for preproduction data and research results, including negative data regarding failed experiments). *See also* Hutter, *supra* note 221, at 19.

266. *See, e.g.*, RESTATEMENT (SECOND) OF AGENCY § 395 (1957); 1 MILGRIM, *supra* note 214, § 5.02[1], [2]. Whether the state "employee invention" statutes will help to change this pro-employer bias of trade secret law remains an open question. *See supra* note 81. By their terms, such statutes apply only to express contractual allocations of ownership between the employer and employee. The version adopted in Illinois provides expressly that the act "shall not preempt existing common law applicable to any shop rights of employers with respect to employees who have not signed an employment agreement." ILL. REV. STAT. ch. 140, para. 302(2) (1985).

267. *See Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141, 160 (1989); *Kewanee Oil Co. v. Bicron Corp.*, 416 U.S. 470, 476, 489-90, 493 (1974) (emphasizing the role of trade secret law in technological and scientific advancement).

268. *Speck v. North Carolina Dairy Found.*, 319 S.E.2d 139, 144-45 (N.C. 1984). *But see* Chew, *supra* note 24, at 298-304 (criticizing *Speck*).

c. Disclosure and Commercial Exploitation

The premises set out above could put university professors under an initial duty to disclose unpatented innovation to their employers, who might, for example, opt to exploit such discoveries for nonprofit uses.²⁶⁹ As an employee of a university that intends to exploit unpatented research results, moreover, the professor arguably labors under a duty of confidentiality that, at the limit, could impede his or her right to publish without the employer's consent, lest the value of the secret be destroyed.²⁷⁰ To avoid these and other uncertainties, the university's employment contract should recognize a professor's need to disseminate research results. If conflicts of interest cannot otherwise be resolved, the contract should further specify that the professor's right to disseminate always prevails over the university's rights to commercialize these same results.²⁷¹ Finally, the employment contract should expressly allocate the proprietary rights to tangible embodiments of applied scientific know-how developed within the scope of employment.²⁷² If these rights go to the university, such an agreement should likewise transfer to the university any exclusive rights to fixed embodiments of research results

269. See *supra* note 268 and accompanying text; 1 MILGRIM, *supra* note 214, § 5.02[2], [4]. Cf. RESTATEMENT (SECOND) OF AGENCY § 393 cmt. c (1957). The employee's duty to disclose innovation to his employer can be derived from a determination that it is the employer's "property" and from the policy objective of protecting the employer's investment in research and development. Cf. Korn, *supra* note 10, at 206-07, 220-21. An employee's duty to disclose also derives from his or her obligation to protect the employer's interests and from the employee's fiduciary responsibilities in general, obligations of paramount importance in the British cases. See, e.g., GURRY, *supra* note 216, at 179 (stating that "the employee is bound to disclose to his employer any valuable information which he receives in his capacity as an employee and which is unknown to his employer . . . including any confidential information which would further the employer's trade"); CORNISH, *supra* note 57, at 228-29.

270. See *supra* text and authorities accompanying notes 223, 252, 269. Cf. Korn, *supra* note 10, at 206-07 (noting that many universities generally recognize an industrial sponsor's right to review a publication for patentable results but not to prevent publication; and stating that while some distinguished institutions impose a nearly complete ban on confidential research in the laboratory, others equally distinguished provide some protection for the proprietary information of industrial sponsors).

271. See, e.g., Korn, *supra* note 10, at 218-21, 226-27; see also Horton, *supra* note 69, at 215; Eisenberg, *Academic Freedom*, *supra* note 206, at 1399-1401.

272. See, e.g., Boonin, *supra* note 238, at 266 (stating that the "time has perhaps come when universities will have to establish policies regulating the exploitation for personal gain of knowledge obtained while doing scientific research as a member of a university community"); Nelsen, *supra* note 85, at 365, 368 (tangible research property treated like patents because of licensing possibilities).

that the copyright law happened to vest in authors, in order to avoid fragmenting the exploitation rights for purely technical reasons.²⁷³

Even when the employment agreement implements a carefully elaborated transfer of technology policy, the difficulties of adapting trade secret law to conditions at public or private universities remain daunting. For example, the logic of trade secret protection may require professors interested in commercializing their discoveries to put junior members of a research team, including graduate students, under nondisclosure and, perhaps, noncompetition agreements.²⁷⁴ Such practices have already become necessary under certain sponsored research agreements because the sponsoring firms insist on reasonable precautions to protect the resulting information.²⁷⁵ Trade secret protection, as judicially interpreted, may also require elaborate restrictions on access to confidential information; procedures for clearing speeches and publications; use of signs and cautionary signals; document handling and routing techniques;²⁷⁶ and, with specific regard to software, the use of coded, self-destructive embodiments and special programs to identify key or typical trade secrets.²⁷⁷ These constraints on teaching and discussion manifestly conflict with a university's academic mission.²⁷⁸ Even then, they may not suffice to prevent leakage of valuable secrets, especially if outside firms enroll employees at the university who can "study" under professors known to be working on a research project of interest to these firms.

Once principal investigators leave the university, moreover, courts may narrow the implied duties of confidentiality that arose during the employment relation even though the university's contract imposed

273. See 17 U.S.C. §§ 101 (definition of "fixed"), 102(a) (1988 & Supp. III 1991) (applying federal copyright law only to original works of authorship *fixed* in any tangible medium of expression); *supra* notes 132-58 and accompanying text (discussing works made for hire under the Copyright Act of 1976 in the university employment context).

274. See, e.g., Korn, *supra* note 10, at 218-21, 226-27. See also 2 JAGER, *supra* note 245, § 8.01[2][c]; 1 MILGRIM, *supra* note 214, § 3.05[1].

275. See Korn, *supra* note 10, at 207-08; *supra* note 270. See also Chew, *supra* note 24, at 293-98 (discounting problems of government regulations).

276. See, e.g., Rockwell Graphic Sys. v. DEV Indus., 925 F.2d 174 (7th Cir. 1991).

277. See Milgrim, *Computer Programs*, *supra* note 228, at 3-11 to 3-16 (citing authorities).

278. See Korn, *supra* note 10, at 204-08; Eisenberg, *supra* note 59, at 216-17 (reasoning that when an inventor, or his sponsor, is motivated by the rewards of marketing a patented invention, he will delay disclosure until a patentable invention has been produced, and will maintain secrecy throughout the patent review process in order to preserve trade secret protection in case the patent application is rejected). "Nevertheless, most . . . universities will admit that there is a technology to be transferred in addition to the patent rights, and that . . . [it] may require the cooperation of university personnel to be effectively transferred." Nelsen, *supra* note 85, at 372.

express constraints on the use of trade secrets after employment ended.²⁷⁹ In principle, post-employment constraints on employees having access to proprietary and confidential information are upheld if reasonable in time and scope, especially when directed against competitive activities of the former employees.²⁸⁰ Conversely, these agreements cannot prevent a former employee from using his or her knowledge, skills and experience in subsequent employment, even in competition with the former employer, if such use does not reveal or threaten to reveal the former employer's trade secrets or otherwise breach a valid restrictive covenant.²⁸¹ Implementing these opposing principles becomes difficult in practice because on-the-job conditions inherently tend to merge some of the employer's trade secrets with the employee's skill and experience.²⁸² The resulting conflict of interests poses even thornier questions of law and policy than the proprietary disputes normally encountered under the federal patent and copyright systems.

The patent system, in particular, limits protection to novel matter, specifically claimed in the application, that survives the examination process,²⁸³ and the patent itself becomes available to the public in due course.²⁸⁴ These claims, in turn, give former employees constructive notice of particular information not to be used on a new job, and this eases the burden of responsibility to a former employer.²⁸⁵ Because the boundaries of a patented invention are thus well-defined, courts can readily enjoin one who infringes a patent with a former employee's help

279. See, e.g., Milgrim, *Computer Programs*, *supra* note 228, at 3-17 to 3-18; Davidson, *supra* note 233, at 12. Cf. ROBERTSON, *supra* note 51, at 91 (discussing *Faccenda Chicken Ltd. v. Fowler*, [1986] 1 All E.R. 617 (Eng. C.A.)). Express restrictions are especially important if the former employee was the person who actually developed the trade secret in question. See Davidson, *supra* note 233, at 12.

280. See, e.g., *Business Intelligence Servs. v. Hudson*, 580 F. Supp. 1068 (S.D.N.Y. 1984) (upholding employee's one-year, world-wide noncompetition clause pertaining to secret computer software, despite evidence of employer's misrepresentation, because the employee's knowledge would become obsolete after the one-year period); Scheinfeld & Butter, *supra* note 232, at 410-12. See also 1 MILGRIM, *supra* note 214, § 3.05[1]. The restrictive covenant must, however, give fair notice of the intended constraint, and it must not contain provisions that violate statutes limiting restrictions on the freedom to work or ply a trade. See Davidson, *supra* note 233, at 12.

281. 1 MILGRIM, *supra* note 214, §§ 3.05[1][b], 5.02[3]; Hutter, *supra* note 221, at 13. See also ROBERTSON, *supra* note 51, at 91-98.

282. See, e.g., *Dynamics Research Corp. v. Analytic Sciences Corp.*, 400 N.E.2d 1274, 1286 (Mass. App. Ct. 1980). See also DRATLER, *supra* note 21, § 4.05[1][a].

283. See 35 U.S.C. §§ 102, 103, 111, 112, 131 (1988); *supra* note 168 and accompanying text.

284. 35 U.S.C. § 153 (1988).

285. See, e.g., 2 ROSENBERG, *supra* note 25, § 11.09 (stressing that the employer's burden of proof includes demonstrating circumstances that would make the employee's prejudicial disclosure inequitable).

from using only the novel matter claimed in the successful application.²⁸⁶

In contrast, when the former employer seeks to protect unpatented know-how as a trade secret, the quantum of protectible technology carried away by a former employee will often be ill-defined, surrounded by public-domain matter, and deeply intertwined with the employee's general expertise and skill in the art.²⁸⁷ The difficulties of separating confidential information from other information that the employee can freely use or disclose makes it harder to prevent former employees from bearing technological secrets to competitors without unduly burdening their ability to work in their chosen fields.²⁸⁸ These uncertainties augment the risk associated with investing in the development of new technology and expose technical employees who change jobs to greater risk of legal action.

Because trade secrets forfeit protection once secrecy is lost, the former employer stands to lose more if his former employees bear applied scientific know-how to competitors than would generally be true in the case of technology already disclosed in a patent.²⁸⁹ Producers of copyrighted computer programs seem particularly vulnerable in this respect because Copyright Office Regulations do not require full disclosure even when the program is accepted for registration,²⁹⁰ and because federal appellate courts have upheld a third party's right to reverse-engineer noncopyrightable matter by proper means.²⁹¹ Effective protection of computer programs thus depends as much or more on keeping source

286. It should be remembered, however, that the grant of a patent carries no concomitant duty to disclose ancillary trade secrets, such as manufacturing methods and processes, provided that the patentee has otherwise disclosed the best mode of practicing the invention. *See, e.g., Christianson v. Colt Indus. Operating Corp.*, 822 F.2d 1544, 1563-64 (Fed. Cir. 1987), *vacated on other grounds*, 486 U.S. 800 (1988), *reaffirmed in part*, 870 F.2d 1292, 1302-03 (7th Cir. 1989); *infra* note 289.

287. *See* 1 MILGRIM, *supra* note 214, § 5.02[3].

288. *See, e.g.,* 2 ROSENBERG, *supra* note 25, § 11.09; ROBERTSON, *supra* note 51, at 94.

289. *See generally* 1 MILGRIM, *supra* note 214, § 5.02[4][c], at 5-72 to 5-74 (arguing that the alternative of granting a shop right to the employer presents a less attractive solution to the problem when a trade secret is at issue, rather than a patent, because the secrecy necessary to maintain the employee's trade secret protection could be destroyed if the employee is required to disclose it to the employer, who may not take adequate precautions to keep the secret; patent protection presents no such difficulty because it does not depend on the maintenance of secrecy).

290. 37 C.F.R. § 202.20(c)(2)(vii) (1992) (registrable copy of computer program must exhibit identifiable portions of the program in form that is visually perceptible without the aid of a machine). "To satisfy the 'identifiable portion' requirement, a registrant typically deposits the first and last twenty-five pages (or its equivalent units of source code) together with the page or equivalent unit having the copyright notice, if any . . . [This] requirement does not preclude trade secret protection for portions of the registered computer programs not deposited." Scheinfeld & Butter, *supra* note 232, at 404.

291. *See supra* note 199 and accompanying text.

codes under actual or legal secrecy as on copyright protection of any "expression" (but not any ideas) the programs may contain.²⁹² Yet, fear of hindering an employee-programmer's ability to work in his or her chosen field may appeal more to some courts' sense of equity than concerns about the employers' incentives to invest in research and development,²⁹³ especially if the employee largely developed the innovation in the first instance.²⁹⁴ The difficulty of framing an injunction that adequately protects both parties to a trade secret dispute may further disincline a court to protect employer against former employee even in the presence of an employment contract that purports to regulate post-employment uses.²⁹⁵

To the extent that courts conscientiously weigh these underlying equitable and policy considerations, proprietary decisions concerning trade secrets become more uncertain and unpredictable than corresponding decisions concerning patents. This potential uncertainty could destabilize the protection of computer programs in particular because all three legal regimes can apply to overlapping components of the same static program design,²⁹⁶ and because the scope of protection likely to be afforded to either the patented or the copyrighted components remains unclear at the time of writing.²⁹⁷ In this respect, the "burdens of overlapping claims" that already tend to convert software innovators into software litigators²⁹⁸ foreshadow equally disconcerting ownership controversies likely to surround other subject-matter categories in the new landscape of intellectual property rights.

292. See 17 U.S.C. § 102(b) (1992); *Computer Assocs. Int'l v. Altai, Inc.*, 982 F.2d 693, 717 (1992) (stating that trade secret protection "remains a uniquely valuable weapon in the defensive arsenal of computer programmers"); *Bender*, *supra* note 51, at 920, 921-22.

293. See, e.g., *Plains Cotton Coop. Ass'n. v. Goodpasture Computer Serv.*, 807 F.2d 1256, 1262-63 (5th Cir. 1987); *Faccenda Chicken Ltd. v. Fowler*, [1985] 1 All E.R. 724 (Eng.).

294. See, e.g., *Davidson*, *supra* note 233, at 12.

295. See generally John Hull, *Employee's Know-How and Secrecy Covenants*, 10 E.I.P.R. 387 (1988) (warning against over-reliance on restrictive covenants to protect employers' trade secrets).

296. See *Maier*, *supra* note 94. Cf. *Horton*, *supra* note 69, at 215 (noting difficulties when patents, copyrights and industrial design rights overlap in Research and Development agreements, including possible ownership claims of outside consultants).

297. See, e.g., *Milgrim*, *Computer Programs*, *supra* note 228, at 3-20 to 3-21 (contending that major cases of software copyright infringement, when properly analyzed, were really theft of trade secret cases in disguise, and citing—among others—*Whelan Assocs. v. Jaslow Dental Lab.*, 609 F. Supp. 1307 (E.D. Pa. 1985), *aff'd*, 797 F.2d 1222 (3d Cir. 1986), *cert. denied*, 479 U.S. 1031 (1987)); *supra* notes 131, 193 and accompanying text (decisions that reject *Whelan*).

298. See *Programs as Know-How*, *supra* note 3, at 683-99.

2. Other Proprietary Regimes

a. Integrated Circuit Designs

The Semiconductor Chip Protection Act of 1984 (SCPA)²⁹⁹ has added another level of proprietary rights to an already overloaded intellectual property scaffold. This act provides ten years of protection to "mask works," that is, to the surface images of integrated circuit designs that are embodied in semiconductor chip products.³⁰⁰ The SCPA protects eligible mask works against copying only, but not against independent creation.³⁰¹ In addition to exclusive reproduction and distribution rights,³⁰² the SCPA also provides owners of mask works with the exclusive right to import a semiconductor chip product in which the mask work is embodied.³⁰³

The SCPA combines a threshold prerequisite of originality (in the sense of independent, uncopied creation) with a loose novelty requirement,³⁰⁴ and it also mandates fixation of the mask work in a

299. Pub. L. No. 98-620, 98 Stat. 3335, 3347 (Nov. 8, 1984), *codified* in Ch. 2, 17 U.S.C. §§ 901-914 (1988).

300. 17 U.S.C. §§ 901, 902, 904 (1988). "A semiconductor chip product or 'integrated circuit' is a complete electronic circuit in a tiny package, typically measuring an inch or less on a side The heart of the product . . . contain[ing] the active electronic circuitry . . . is a tiny 'chip' of silicon or other semiconductor material, on which electronic circuitry has been deposited using microscopic manufacturing techniques." DRATLER, *supra* note 21, § 8.01[1]. "[A] mask is simply a template whose configuration controls the deposition, doping, or etching of specific areas on each succeeding layer of the wafer" that constitutes the three-dimensional structure of the integrated circuit. *Id.* § 8.01[3]. The design of a chip is "the design of the mask information used to make it." *Id.* § 8.01[4]. The purpose of the SCPA is to protect designs of semiconductor chip products. Rather than using the term "design," however, the statute creates a new form of intellectual property, termed "mask work", which "comprises the abstract information in the set of masks used to manufacture a particular semiconductor chip product." *Id.* §§ 8.03[1], 8.03[1][a].

301. 17 U.S.C. § 905(1) (1988). *See generally* DRATLER, *supra* note 21, § 8.04[1][b] (noting that Congress borrowed the test of substantial similarity from copyright law to prohibit, in addition to slavish or literal copying, "two kinds of nonverbatim copying: (1) copying of the entire mask work, but not exactly; and (2) exact or similar copying of an important portion of the mask work, such as a cell from a cell library").

302. 17 U.S.C. § 905(1), (2) (1988).

303. *See id.* § 910(a) (1988); H.R. REP. NO. 781, 98th Cong., 2d Sess. 25-26 (1984), *reprinted* in 1984 U.S.C.C.A.N. 5750, 5766.

304. *See* 17 U.S.C. §§ 902(b)(1) (excluding designs that are not "original"), 902(b)(2) (excluding designs that are "staple, commonplace, or familiar in the semiconductor industry, or variations of such designs combined in a way that, considered as a whole, is not original") (1988). *See also* H.R. REP. NO. 781, *supra* note 303, at 17 (stating that "originality" means independent creation, but referring to a definition of originality not included in the statute as finally enacted); Richard H. Stern, *Determining Liability for Infringement of Mask Work Rights Under the Semiconductor Chip Protection Act*, 70 MINN. L. REV. 271, 317 n.150 (1985) (uncertain from legislative history whether the proposed definition of originality was omitted merely as surplusage or for other reasons); Leo J.

semiconductor chip product by authority of the "owner."³⁰⁵ Ownership of the mask work normally vests "in the person who created" it (or his legal representative if the creator is deceased or incapacitated) or in "a party to whom all the rights . . . of such a person or representative are transferred."³⁰⁶ If, however, a mask work is "made within the scope of a person's employment, the owner is the employer for whom the person created the mask work" or that employer's assignee.³⁰⁷ In either case, the exclusive rights to reproduce, import or distribute a protected mask work belong to the owner, who may transfer or license these rights.³⁰⁸

Because the legislative history of the SCPA indicates that the layout of an integrated circuit design does not constitute an expression of the author's personality, courts may construe the provisions vesting ownership in employers more broadly than under copyright law.³⁰⁹ Clearly, in using the term "person" Congress did not intend to exclude the business organizations that ordinarily design and manufacture semiconductor chips.³¹⁰ On the contrary, the notion of "employer-creator" implicit in § 901(a)(6) parallels the "employer-author" under the work-for-hire doctrine of copyright law,³¹¹ but restrictions favoring independent contractors in the definition of "employer-author" were not carried over to the SCPA.³¹² This failure to mention commissioned works could imply that the commissioning party should own the end product even when the relationship would not qualify as a "work made

Raskind, *Reverse Engineering, Unfair Competition, and Fair Use*, 70 MINN. L. REV. 385, 391-92 & n.30 (1985) (concluding that the SCPA's definitions of originality incorporate some connotation of novelty). How this originality standard should be combined with the SCPA's exemption of reverse engineering from liability for infringement is controversial. See *infra* notes 337-39 and accompanying text.

305. 17 U.S.C. § 902(a)(1) (1988).

306. *Id.* §§ 901(a)(6) (definition of owner), 903 (1988).

307. *Id.* § 901(a)(6). Employee creation of mask works is the norm. See John G. Rauch, *The Realities of Our Times: The Semiconductor Chip Protection Act of 1984 and the Evolution of the Semiconductor Industry*, 75 J. PAT. & TRADEMARK OFF. SOC'Y 93, 109 n.104 (1993).

308. 17 U.S.C. §§ 903(a)-(b), 905 (1988).

309. See, e.g., CONG. REC. H11,611 (daily ed. Oct. 8, 1984) (statement of Chairman Kastenmeier); CONG. REC. S12,924 (daily ed. Oct. 3, 1984) (statement of Sen. Mathias). But cf. H.R. REP. NO. 781, *supra* note 303, at 17 (referring to § 901(6) and stating that "[t]his section's definition of ownership is similar to conventional copyright principles of ownership of a work"). See also 3 NIMMER, *supra* note 112, § 18.04[B].

310. See 17 U.S.C. § 901(a), (b) (1988); DRATLER, *supra* note 21, § 807[2].

311. Compare 17 U.S.C. § 101 (1988) (definition of "work made for hire," paragraph (1)) and § 201(a), (b) (1988) with 17 U.S.C. § 901(a)(6) (1988).

312. Compare *id.* § 101 (definition of "work made for hire," paragraph (2)) with *id.* § 901 (a), (b). See *supra* text accompanying notes 123-29.

for hire" under the restrictive criteria the Supreme Court recently adopted for copyrightable works of authorship.³¹³

At the same time, the SCPA appears to embody a modified principle of divisible ownership that differs from that of the copyright law.³¹⁴ Under copyright law, a transferee of any exclusive right (including the exclusive licensee of any subdivided segment of an exclusive right) is an "owner . . . entitled to all of the protection and remedies accorded to the copyright owner,"³¹⁵ but the latter may eventually exercise the right to terminate all transfers.³¹⁶ The SCPA provides no comparable right to terminate transfers, hence identifying the party in whom ownership initially vests becomes correspondingly less important.³¹⁷ Under the SCPA, however, only a *transferee of all rights* is an "owner," while a *licensee* of all or some of the rights is not.³¹⁸ This nuance could affect either the right to register the mask work, which belongs only to an "owner,"³¹⁹ or the right to bring an infringement action, which belongs to an exclusive licensee of all rights but not to lesser licensees.³²⁰ Should the owner of a mask work neglect to apply for registration within two years after the date of first commercial exploitation at home or abroad, all protection under the SCPA is forfeited.³²¹

The SCPA does not preempt rights arising under the copyright or patent statutes, nor does it preclude copyright or patent protection of works embodied in a chip other than the mask work itself.³²² For example, a patentable circuit design can be protected separately from the

313. See *supra* notes 125-27 and accompanying text. In an actual dispute over proprietary interests that depended on the scope of employment, the outcome would depend on the application of the federal common law of agency. See DRATLER, *supra* note 21, § 8.07[2].

314. Compare 17 U.S.C. § 901(a)(6) (definition of "owner" of mask work) and § 903 with 17 U.S.C. § 201 (ownership of copyright).

315. See *id.* §§ 101 (defining "transfer of copyright ownership"), 201(d) (divisible ownership).

316. See *id.* § 203 (1988).

317. *Id.* § 903 (1988). Cf. *supra* notes 113-18 and accompanying text.

318. See *id.* §§ 901(a)-(b), 903(b) (1988). Universities need to evaluate these provisions. See, e.g., Nelsen, *supra* note 85, at 365, 368 (assimilating university interest in mask works to university regulation of tangible research projects, but omitting reference to SCPA and its requirements).

319. *Id.* § 908(a) (1988). See also *id.* § 901(a)(6) (recognizing "owner" as creator, creator's legal representative, employer-creators, "or a party to whom all the rights . . . are transferred in accordance with section 903(b)").

320. *Id.* § 910(b)(1) (1988). See CONG. REC. S12,916-17 (daily ed. Oct. 3, 1984) (statement of Sen. Mathias).

321. 17 U.S.C. § 908(a). This contrasts with post-1988 copyright law, which makes registration permissive but not a condition of protection. See *id.* § 408(a) (1988), as amended in 1989.

322. See *id.* § 911(a), (b) (1988).

layout, even though the layout may qualify as a mask work.³²³ Friction between the patent and chip laws is reduced by a provision in the SCPA denying protection to "any idea, procedure, process, system, method of operation, concept, principle, or discovery, regardless of the form in which it is described, explained, illustrated, or embodied" in a mask work.³²⁴ Although a patent on a given element appears to suggest that it is a non-protectible "idea" for purposes of this provision, the ability to produce a functionally equivalent element by different, non-infringing means could entitle a particular mode of implementation to mask work protection.³²⁵

Relations between the SCPA and copyright law are less clear. Formally, the SCPA precludes copyright protection for mask works,³²⁶ and it also preempts state laws providing rights or remedies that are equivalent to those conferred by the SCPA itself.³²⁷ At the same time, the copyright law continues to protect a computer program stored in a chip.³²⁸ This presumably applies to the microcode of the Read Only Memory (ROM) component in a microprocessor because the copyright on the microcode exists independently of any mask work protection for the layout of the microprocessor chip.³²⁹ Whether the integrated circuit design is technically separable from the associated program in all cases remains questionable, however.³³⁰ In this and other situations, ingenious arguments will attempt to portray the mask work as a derivative work based on the copyrighted computer program.³³¹ Such arguments merit skepticism, however, because they lead to indirect protection of noncopyrightable, utilitarian matter³³² and because they conflict with

323. See, e.g., *Brooktree Corp. v. Advanced Micro Devices, Inc.*, 977 F.2d 1555, 1562-63 (Fed. Cir. 1992); H.R. REP. NO. 781, *supra* note 303, at 28.

324. 17 U.S.C. § 902(c) (1988); H.R. REP. NO. 781, *supra* note 303, at 19. Cf. 17 U.S.C. § 102(b) (1988).

325. See DRATLER, *supra* note 21, § 8.06[5][b].

326. See 17 U.S.C. § 912(b) (1988); H.R. REP. NO. 781, *supra* note 303.

327. See 17 U.S.C. § 912(c). Cf. *id.* § 301 (1988).

328. See *id.* § 912(a) (1988). For the copyrightability of microcode, see, e.g., *NEC Corp. v. Intel Corp.*, 10 U.S.P.Q.2d (BNA) 1177 (N.D. Cal. 1989).

329. H.R. REP. NO. 781, *supra* note 303, at 28.

330. Cf. *Brooktree Corp. v. Advanced Micro Devices, Inc.*, 977 F.2d 1555 (Fed. Cir. 1992).

331. See, e.g., DRATLER, *supra* note 21, § 8.06[5][c].

332. See, e.g., *Brooktree*, 977 F.2d at 1570. See generally Reichman, *Electronic Information Tools*, *supra* note 5, at 813-20 ("The Derivative Work at Odds With Information Technologies").

the letter and spirit of the Supreme Court's decision in *Baker v. Selden*.³³³

The SCPA does not preempt state trade secret laws, provided that these laws require secrecy as a condition of protection and do not prohibit third parties from copying mask works in connection with the "reverse-engineering" of semiconductor chips distributed on the open market.³³⁴ State law thus comes mainly into play before a mask work is either registered or commercially exploited, that is, during the period when protection under the SCPA has not yet ripened.³³⁵ Once the SCPA applies, it expressly authorizes reverse-engineering of the publicly distributed chip or parts thereof,³³⁶ and, in principle, a competitor has not copied a protected mask work if his or her own independently generated chip design incorporates the results of reverse-engineering and meets the statutory test of originality.³³⁷ Product simulation obtained by reverse-engineering, as opposed to unauthorized duplication, could thus constitute as perfect a defense to an infringement action under the SCPA as to an action for the misappropriation of trade secrets in general.³³⁸ In close cases, however, courts implementing the SCPA could require a third party who reverse-engineers a protected mask work to show that his allegedly infringing mask work enhanced the performance of the semiconductor chip products in question.³³⁹

333. See *Baker v. Selden*, 101 U.S. 99 (1879); *Atari Games Corp. v. Nintendo of Am.*, 975 F.2d 832, 839-41 (Fed. Cir. 1992); *Sega Enters. v. Accolade, Inc.*, 977 F.2d 1510, 1524-26 (9th. Cir. 1992). Cf. 17 U.S.C. § 113(b) (1988). See generally *Programs as Know-How*, *supra* note 3, at 692-93, 693 n.288.

334. See H.R. REP. NO. 781, *supra* note 303, at 28-29.

335. See 17 U.S.C. §§ 904(a), 912(c) (1988).

336. See *id.* § 906(a)(1), which expressly allows third parties "to reproduce the mask work solely for the purpose of teaching, analyzing, or evaluating the concepts or techniques embodied in the mask work or the circuitry, logic flow, or organization of components used in the mask work," and § 906(a)(2), which exonerates "a person who performs the analysis or evaluation described in paragraph (1) to incorporate the results of such conduct in an original mask work which is made to be distributed."

337. See *Brooktree*, 977 F.2d at 1565 (Fed. Cir. 1992) (stating that the "statute thus provides that one engaged in reverse engineering shall not be liable for infringement when the end product is itself original"); *supra* notes 304, 336. See also *Rauch*, *supra* note 307, at 117-23.

338. Cf. *supra* text and authorities accompanying notes 221-24.

339. See *Brooktree* at 1569-70 (holding that defendant's "paper trail" of reverse-engineering did not excuse close copying without a showing that functional capabilities were improved because the paper trail may bear entirely on the defendant's failures). See also *Rauch*, *supra* note 307, at 121 ("The legitimate reverse engineer may leave no paper trail, while the pirate can readily invent one."). The first authoritative decision on this issue (*Brooktree*) thus sides with those commentators who argue that a second comer's mask work, produced after reverse-engineering a protected mask work, must establish originality by showing functional improvement and not just the toil and investment reflected in a paper trail. See, e.g., *Raskind*, *supra* note 304, at 402; Harold R. Brown, Note, *Fear and Loathing of the Paper Trail: Originality in Products of Reverse Engineering Under the Semiconductor Chip Protection Act as Analogized to the Fair Use of Nonfiction Literary*

Indeed, one could argue that the SCPA, with its exclusion of circuit designs "that are staple, commonplace or familiar in the semiconductor industry"³⁴⁰ and its encouragement of reverse-engineering, merely provides a statutory form of pseudo-trade secret protection for a single class of functional designs whose know-how is too easily appropriated by technological means.³⁴¹ This, in turn, begs the question of why this particular class of functional designs merits an exemption from the discipline of the marketplace more than other classes of socially valuable innovation that are no less vulnerable to free-riding duplicators. Enactment of the SCPA in the United States and the corresponding demands of reciprocity successfully lodged against the rest of the world³⁴² have thus implanted a protectionist virus at the heart of the international intellectual property system, which otherwise rests on the patent and copyright paradigms.³⁴³ The effects of this virus are clearly

Works, 41 SYRACUSE L. REV. 985, 1012-20 (1990) (arguing that "a good faith attempt to enhance technology" should satisfy the originality test, even if no functional superiority was attained). Portions of the legislative history can be read, however, to require only "significant toil and investment" resulting in a lack of substantial identity between the chip designs in question. See *id.* at 1006-08 (citing authorities). See also RICHARD H. STERN, SEMICONDUCTOR CHIP PROTECTION 198-99 (1986) (linking "originality" under SCPA to a showing of "nontrivial differences" from the prior art); DRATLER, *supra* note 21, § 8.03[3][c], [f] (assuming independent creation and a modicum of creativity by two firms who arrive at quite similar designs, both designs would retain protection if neither is "familiar" or standard in the trade).

340. 17 U.S.C. § 902(b)(2) (1988).

341. See, e.g., H.R. REP. NO. 781, *supra* note 303 at 27-29 (finding that "in several months and for a cost of less than \$50,000" a copyist can copy a mask work from a chip that has been placed on the market). See also Reichman, *Designs and New Technologies*, *supra* note 40, at 27-29, 136-38.

342. In characterizing the SCPA as a set of rights allied to copyright law but not within the international copyright conventions, Congress in effect conditioned the recognition of foreign mask-work proprietors on a showing of material reciprocity between United States law and that of the foreign national's own state. See 17 U.S.C. §§ 902(a)(1)-(A)-(C), 913, 914 (1988 & Supp. III 1991) (allowing protection for foreign mask works that are first commercially exploited in this country, or that are covered by an apposite treaty, or that fall within a presidential proclamation recognizing that material reciprocity exists under the laws of the foreign national's own state). See also STERN, *supra* note 339, at 377-444; McManis, *supra* note 56; Jay A. Erstling, *The Semiconductor Chip Protection Act and Its Impact on the International Protection of Chip Designs*, 15 RUTGERS COMPUTER & TECH. L.J. 303 (1989). To the extent that the SCPA actually created a new form of industrial property, however, its denial of national treatment arguably violated the spirit if not the letter of the Paris Convention. See, e.g., CONG. REC. H11,611 (daily ed. Oct. 9, 1984) (statement of Congressman Kastenmeier, Chairman of the House Subcommittee, to the effect that mask works represent a "new form of industrial property"). See also Reichman, *GATT Connection*, *supra* note 17, at 850-53. But see Hans Peter Kunz-Hallstein, *The United States Proposal for a GATT Agreement on Intellectual Property and the Paris Convention for the Protection of Industrial Property*, 22 VAND. J. TRANSNAT'L L. 265, 278 (1989).

343. See Reichman, *Legal Hybrids*, *supra* note 3, at 326-32.

visible in the United Kingdom's new unregistered design right, which confers copyright-like protection on functional designs generally.³⁴⁴

b. The United Kingdom's Unregistered Design Right

Viewed as laws that protect a single class of functional designs, neither the Semiconductor Chip Protection Act³⁴⁵ nor its British counterpart³⁴⁶ appear to overlap or conflict with, respectively, the United States Design Patent Act of 1842³⁴⁷ and the United Kingdom's Registered Designs Act of 1949,³⁴⁸ both of which protect innovative ornamental designs of useful articles.³⁴⁹ Although the Court of Appeals for the Federal Circuit has revitalized the design patent law³⁵⁰ and Parliament has recently amended the Registered Designs Act,³⁵¹ both laws continue to protect only designs that appeal to the eye and that are not functionally determined.³⁵² Because so-called "mask works" or Semiconductor Chip "topographies," as they are known in the United Kingdom,³⁵³ are dictated by functional considerations,³⁵⁴ Anglo-

344. See *infra* notes 363-66 and accompanying text. The Commission of the European Communities is studying a proposal that would extend a version of the U.K.'s functional design right to all member countries. See Hugh Griffiths, *Overview of Developments in Europe on Industrial Design Protection*, paper presented to the First Annual Conference on International Intellectual Property Law and Policy, Fordham Corporate Law Institute, Fordham University School of Law, April 15-16, 1993.

345. See *supra* note 299.

346. See PETER GROVES, COPYRIGHT AND DESIGNS LAW—A QUESTION OF BALANCE 301-02 (1991) (discussing Semiconductor Products (Protection of Topography) Regulations of 1987, superseded by new regulations in 1989); *infra* note 360.

347. Act of August 29, 1842, ch. 263, § 2, 5 Stat. 543 (1842) (current version at 35 U.S.C. §§ 171-173, 289 (1988)).

348. See Registered Designs Act, 1949, 12, 13 & 14 Geo. 6, ch. 88 (Eng.) [hereinafter RDA], amended by Copyright, Designs and Patents Act, 1988, ch. 48, §§ 265-73 (Eng.) [hereinafter CDPA].

349. See 35 U.S.C. §§ 102, 103, 171 (1988) (allowing patent protection for "any new, original and ornamental design for an article of manufacture"); CDPA, *supra* note 348, § 265(1) (continuing in this respect RDA, *supra* note 348, § 1(1)).

350. See Reichman, *Designs and New Technologies*, *supra* note 40, at 30-56; J.H. Reichman, *Current Trends in the Protection of Industrial Designs: Section 43(a) of the Lanham Act and the Revival of the Design Patent Law*, unpublished paper presented to the 37th Annual Conference on Developments in Intellectual Property Law, The John Marshall Law School, Chicago, Ill., Feb. 25-26, 1993.

351. See *supra* note 348.

352. See, e.g., *Power Controls Corp. v. Hybrinetics, Inc.*, 806 F.2d 234 (Fed. Cir. 1986); *Chrysler Motors Corp. v. Auto Body Panels of Ohio*, 908 F.2d 951 (Fed. Cir. 1990); CDPA, *supra* note 348, § 265 (1) (excluding features dictated solely by function and rejecting the design of an article "if the appearance of the article is not material" in the sense that persons acquiring or using it would not normally take "aesthetic considerations . . . into account to a material extent"). See also Reichman, *Designs and New Technologies*, *supra* note 40, at 37-42.

353. See *supra* note 300; *infra* note 360 and accompanying text.

American design laws providing patent-like protection could not protect them even if they otherwise met the stringent threshold requirements these laws impose.³⁵⁵ However, the historical lack of protection for purely functional designs under Anglo-American intellectual property laws (which differed in this respect from those countries that protect utility models)³⁵⁶ changed radically in 1988, when the United Kingdom enacted a law to protect unregistered industrial designs without regard to their ornamental character.³⁵⁷

The origins of the United Kingdom's unregistered design law can be traced back to governmental regulations seeking to comply with the reciprocity provisions of the United States Semiconductor Chip Protection Act,³⁵⁸ on the one hand, and to certain anomalous judicial decisions extending copyright protection to functional designs,³⁵⁹ on the other. In the United Kingdom, integrated circuit designs were afforded *sui generis* protection under the Semiconductor Products (Protection of Topography)

354. See *supra* notes 300, 309 and accompanying text.

355. See 35 U.S.C. §§ 102, 103 (1988), incorporated by reference into § 171; CPDA, *supra* note 348, § 265(1), amending RDA, *supra* note 348, § 1(4) (requiring objective relative novelty and a material differentiation from the prior art, but not necessarily nonobviousness).

356. "From a worldwide perspective . . . the industrialized countries seem increasingly disposed to protect even functional designs that fail to meet the standards of patentability For example, the Federal Republic of Germany, Italy, and Japan provide direct protection of functional designs under utility model laws in addition to *sui generis* protection of appearance designs. Although utility model laws, which are growing in popularity, operate with a stricter legal discipline than that of the design laws, they weaken the standards nominally supposed to govern a mature patent system in subtle and indirect ways." Reichman, *Designs and New Technologies*, *supra* note 40, at 37-38 (citing authorities). See also Roland Liesegang, *German Utility Models After the 1990 Reform Act*, 20 AIPLA Q.J. 1 (1992); Reichman, *Electronic Information Tools*, *supra* note 5, at 806-12 ("The Tool Design in Comparative Industrial Property Law"). A discussion of utility model laws is beyond the scope of this article.

357. CDPA, *supra* note 348, §§ 213-264. See Fellner, *supra* note 55. See also James Lahore, *The Herchel Smith Lecture 1992: Intellectual Property Rights and Unfair Copying: Old Concepts, New Ideas*, 14 E.I.P.R. 428, 428-30 (1992) (discussing 1981 amendments to Australian design law that anticipated the U.K.'s reform of 1988). For a discussion of recent bills tending to introduce such a right into United States law, see Ralph S. Brown, *Design Protection: An Overview*, 34 UCLA L. REV. 1341, 1399 (1987) (criticizing similar proposals); Reichman, *Legislative Agenda*, *supra* note 66, at 290-96.

358. See *supra* note 342 and accompanying text.

359. See *infra* note 377 and accompanying text.

Regulations, which first took effect in November 1987.³⁶⁰ These regulations suppressed *copyright* protection of integrated circuit designs³⁶¹ and instituted an exclusive right to reproduce the pattern or topographical layout of semiconductor chips for a period of ten to fifteen years.³⁶² One year later, in the Copyright, Designs and Patents Act of 1988, the United Kingdom extended the principle of copyright-like protection (derived from semiconductor chip protection laws) to unregistered industrial designs generally.³⁶³

The unregistered design law provides ten to fifteen years of protection for "original," non-copied designs that are either aesthetic or functional in character.³⁶⁴ It appears to require a loose form of novelty (but not nonobviousness) as the main prerequisite of eligibility.³⁶⁵ In contrast, the Registered Designs Act as amended in 1988 now provides up to twenty-five years of protection for novel aesthetic designs that are not primarily determined by functional ends.³⁶⁶

Functional designs protected under the unregistered design law are subject to compulsory licenses and certain other immunities not imposed by the Topography Regulations,³⁶⁷ while the reverse-engineering provision characteristic of the Regulations was not included in the new

360. See GROVES, *supra* note 346, at 301; MERKIN, *supra* note 55, at 208; CORNISH, *supra* note 57, at 390-91. Chip design after August 1, 1989, technically falls within Part III of the CDPA, *supra* note 348, §§ 213-264, which covers unregistered designs. The latest set of regulations ensuring compliance with the pertinent EC Directive, *see infra* note 362 and accompanying text, however, override and substantially modify the unregistered design right in this respect. See GROVES, *supra*, at 301-303 (discussing Design Right (Semiconductor Topographies) Regulations 1989, S.I. 1989, No. 1100 (effective 1 Aug. 1989)).

361. See, e.g., MERKIN, *supra* note 55, at 361; CORNISH, *supra* note 57, at 390-91; *infra* notes 377-79 and accompanying text.

362. See MERKIN, *supra* note 55, at 208. These regulations responded to a 1987 Directive of the Council of the European Communities, which required member countries to afford integrated circuit designs a form of protection comparable to that available under the United States Semiconductor Chip Protection Act of 1984. See CORNISH, *supra* note 57, at 390-91; *supra* note 360.

363. See *supra* note 357.

364. See CDPA, *supra* note 348, § 216; CORNISH, *supra* note 57, at 390-91; Fellner, *supra* note 55, at 377-88.

365. See CDPA, *supra* note 348, §§ 213(1) (protecting "visual" designs), 213(4) (defining "visual" to exclude commonplace designs). Although the precise standard of "originality" required for unregistered design protection was uncertain and controversial pending authoritative interpretation by the courts, *see* Fellner, *supra* note 55, at 377-78, 380, the first decisions appear to introduce "a concept akin to novelty" without insisting on an author's skill and labor. See Brian Turner, *A True Design Right: C & H Engineering v F Klucznik & Sons*, 15 E.I.P.R. 24, 24-25 (1993).

366. CDPA, *supra* note 348, § 265(1) (quoted in part *supra* note 352), § 269.

367. See CDPA, *supra* note 348, §§ 213(3)(b), 237-40; *supra* note 360.

design law.³⁶⁸ The topography regulations as revised in 1989 still continue in force, in compliance with an EC Directive and with the United States reciprocity requirement,³⁶⁹ and they modify the unregistered design right with respect to chip designs.³⁷⁰ Nevertheless, the extent to which topography and unregistered design rights will become assimilated for ownership and infringement purposes remains uncertain pending judicial interpretation.³⁷¹

Meanwhile, the authorship and ownership provisions built into the unregistered design right deserve particular attention because they introduce a new layer of proprietary rights into broad sectors of industrial activity that were once subject to unrestricted competition. According to Professor Cornish, these provisions were modeled on those of the Registered Designs Act of 1949,³⁷² which followed modified patent principles.³⁷³ As a result, a commissioned design under the unregistered design law will initially belong to the commissioning party and not to the creator, in contrast with the workings of copyright law.³⁷⁴ If an employee fashions a protected design within the scope of his or her employment, it will belong to the employer.³⁷⁵ Only if neither of these situations occurs will ownership of an unregistered design vest initially in the designer, unless a written agreement of the parties reallocates the statutory attribution of rights.³⁷⁶

In principle, such a designer could not seek more favorable treatment from copyright law. Indeed, one object of the unregistered design law was to relieve the pressure on copyright law resulting from the tendency of British courts, in the period 1975-1988, to protect three-dimensional functional designs as artistic works derived from two-dimensional technical drawings.³⁷⁷ After August 1, 1989, useful objects portrayed

368. See CORNISH, *supra* note 57, at 391; *supra* notes 334-39, 360 and accompanying text.

369. See *supra* notes 342, 360-62 and accompanying text.

370. See *supra* note 360.

371. See CORNISH, *supra* note 57, at 391.

372. See *supra* note 348.

373. See CORNISH, *supra* note 57, at 387; see generally MERKIN, *supra* note 55, at 308-59.

374. See CDPA, *supra* note 348, §§ 214, 214(1) ("The designer is the first owner of any design right in a design which is not created in pursuance of a commission or in the course of employment."); CORNISH, *supra* note 57, at 387-88.

375. CDPA, *supra* note 348, § 215(3).

376. *Id.* §§ 214(1), 215; see CORNISH, *supra* note 57, at 387-88.

377. See Copyright Act, 1956, 4 & 5 Eliz. 2, ch. 74, §§ 3(1), 48(1), (Eng.) ("artistic works" include engineering drawings "irrespective of artistic quality"); Fellner, *supra* note 46, at 372-73 (concluding that "because they started life as engineering drawings, because copying could be indirect as well as direct, and because it could be done by reproducing a two-dimensional work (the . . . drawing) in three-dimensional form, a host of wholly functional, nonregisterable articles designed without regard to appearance achieved the same protection as the modern equivalents of a Rembrandt, . . . [including such] worthy

in a two-dimensional representation should no longer obtain copyright protection.³⁷⁸ Any future protection they obtain should depend on either the registered or unregistered design rights, and the registered design right applies only to designs that appeal to the eye.³⁷⁹

Nevertheless, even a cursory examination of the unregistered design law leaves the impression that considerable overlap still remains possible between its coverage and that of the United Kingdom's copyright law. For example, "surface decoration" in two-dimensional form qualifies as a "graphic work" in copyright law;³⁸⁰ a three-dimensional version of the same decoration could qualify as sculpture or even as a three-dimensional reproduction in copyright law,³⁸¹ but if the same decoration were partly painted and partly filigree work designed without the drawing, its only protection appears to lie in the *registered* design law.³⁸² Other borderline cases mentioned in the literature include designs for automobiles that arise as three-dimensional models,³⁸³ costume jewelry³⁸⁴ and table lamps cast in three-dimensional, representational shapes.³⁸⁵ Should the commentators' worst fears materialize, a single

articles of commerce [as] . . . screws, bolts, washers, clerical collars, paper-maché bed pans, pulley wheels, and plastic knock-down drawers") (citing authorities). *But see* British Leyland Motor Corp., v. Armstrong Patents Co., [1986] 1 All E.R. 850 (major House of Lords decision excepting spare parts from copyright protection, which led to the 1988 reforms). Copyright protection of functional designs in the U.K., attributed to a legislative miscue in 1968, was avoided in the U.S. by *Baker v. Selden*, 101 U.S. 99 (1879) (as codified in part at 17 U.S.C. § 113(b) (1988)). *See, e.g.,* Reichman, *Designs and New Technologies*, *supra* note 40, at 59-60. *See also* Reichman, *Designs Before 1976*, *supra* note 54 at 1129-32 (tracing evolution of § 113(b)).

378. *See* CDPA, *supra* note 348, §§ 236 (rendering design rights and copyrights noncumulative), 51. *Cf.* 17 U.S.C. § 113(b); *supra* note 377.

379. *See supra* notes 351-52 and accompanying text. *See generally* Fellner, *supra* note 55, at 371-92.

380. *See* CDPA, *supra* note 348, § 4.

381. *See id.*; Fellner, *supra* note 55, at 379.

382. *See* CDPA, *supra* note 348, § 213 (emphasizing features of shape or configuration); RDA, *supra* note 348, § 265 (protecting pattern or ornament applied to an article); Fellner, *supra* note 55, at 379-80.

383. *See* Fellner, *supra* note 55, at 386-88. This example would not pose a problem under current U.S. law, owing to the separability criterion in copyright law and to the partial codification of *Baker v. Selden*, 101 U.S. 99 (1879). *See* 17 U.S.C. §§ 101 (definitions of pictorial, graphic and sculptural works, useful article), 113(b) (1988); Reichman, *Designs and New Technologies*, *supra* note 40, at 56-75.

384. *See* Fellner, *supra* note 55, at 387-88.

385. *See* CORNISH, *supra* note 57, at 389. Professor Cornish suggests that novel design features of the lamp could qualify for 25 years of protection as a registered design; that the lamp design as a whole could attract copyright protection on a number of theories (which protection, however, would last only 25 years from first marketing as applied art, *see* Copyright Act, *supra* note 377, § 52); and that, while eligibility in copyright law would exclude the unregistered design right in any element of shape or configuration, *see* CDPA, *supra* note 348, § 236, certain elements, such as the bulb holder, could attract the unregistered design right for ten years, subject to compulsory licenses, "must fit"

article could sometimes attract all three regimes, and the copyright and design rights might belong to different persons, because "if the designer is freelance then the copyright will belong to him in the absence of assignment, while the design registration and the unregistered design right will belong to the person who commissioned him."³⁸⁶ One authority predicts frequent litigation testing the ambiguities of non-cumulation precisely because of the different rules governing ownership of commissioned works and the disputes they are likely to engender.³⁸⁷

Similar complications seem likely to arise with respect to different components of computer programs. For example, verbally expressed components of a computer program attract copyright protection as literary works,³⁸⁸ while graphically rendered components of the same program could conceivably attract either registered or unregistered design protection (depending on the degree of creativity and functionality and on the presence of aesthetic features) in addition to any residual copyright protection available to these same components *qua* artistic works.³⁸⁹ Imagining how this potential overlap would play out in the case of, say, a faculty-generated user interface numbs the mind. To the extent that statutory lines of demarcation prove ambiguous or unworkable, the authorship and ownership provisions of copyright law may pull in one direction while those rooted in the registered or unregistered design rights pull in the other.³⁹⁰ Moreover, the relation between any of these laws and the law of confidential information insofar as authorship and ownership of trade secrets are concerned cannot accurately be foretold without judicial interpretation. For these reasons, Professor Cornish wryly observes that, in the new landscape of intellectual property rights, a failure to resolve ownership issues by express contract "may lead to awkward dispute."³⁹¹

exemption, and a non-commonplace requirement. CORNISH, *supra* note 57, at 389 (concluding that "[t]he scope for discriminatory argument seems altogether without bounds").

386. Fellner, *supra* note 55, at 380 (stressing negative effects of "[t]hree different rights in one article").

387. CORNISH, *supra* note 57, at 389 n.35.

388. See CDPA, *supra* note 348, § 3(1)(b) (defining "literary work" to include "a computer program").

389. See *supra* text accompanying notes 377, 379-87.

390. See *supra* notes 386-87 and accompanying text.

391. CORNISH, *supra* note 57, at 388. See also Horton, *supra* note 69, at 215.

III. THE NEED FOR A NEW INTELLECTUAL PROPERTY PARADIGM

The foregoing survey of overlapping proprietary rights affecting commercialized university research by no means exhausts the subject, even as regards computer program-related innovation. For example, it does not discuss ownership of trademarks applicable to computer programs,³⁹² including unregistered marks covered by § 43(a) of the Lanham Act,³⁹³ nor does it consider the proprietary conundrums that data bases have lately begun to pose.³⁹⁴ The survey has also omitted any serious discussion of computer-generated productions, computer-aided design and the outputs of artificial intelligence systems, all of which raise uniquely complicated proprietary issues.³⁹⁵

In this connection, one should recall that the United Kingdom's Copyright, Designs and Patents Act of 1988 offers perhaps the first rules for attributing ownership of computer-generated works and designs in the case of nonhuman authorship.³⁹⁶ Derived from early formulas for determining the rights to cinematographic works, the statute ascribes ownership to "the person by whom the arrangements necessary for the creation of the work are undertaken."³⁹⁷ In practice, however, this criterion will seldom be applied to copyrightable literary and artistic works because most of these works still require some human intervention and the presence of any human creation takes the production out of the statute.³⁹⁸ To the extent that the statutory solution is eventually

392. See, e.g., ROBERTSON, *supra* note 51, at 106-10.

393. Lanham Act., ch. 540, § 43(a), 60 Stat. 427, 441 (1946), amended by Trademark Law Revision Act of 1988, §132 (current version at 15 U.S.C. § 1125(a) (1988)). See, e.g., *Engineering Dynamics, Inc. v. Structural Software, Inc.*, 785 F. Supp. 576, 583-84 (E.D. La. 1991); Beutel, *supra* note 53. See also Reichman, *Designs and New Technologies*, *supra* note 40, at 81-123.

394. See, e.g., L. Ray Patterson, *Copyright Overextended: A Preliminary Inquiry into the Need for a Federal Statute of Unfair Competition*, 17 U. DAYTON L. REV. 385 (1992); David Lange, *Sensing the Constitution in Feist*, 17 U. DAYTON L. REV. 367 (1992); Leo J. Raskind, *Assessing the Impact of Feist*, 17 U. DAYTON L. REV. 331 (1992). See also André Lucas, *General Report: Data Bases and Copyright*, in ALAI, L'INFORMATIQUE ET LE DROIT D'AUTEUR 332, 332-49 (1990); Karjala, *supra* note 45; Litman, *supra* note 200, at 185.

395. See, e.g., Samuelson, *Allocating Ownership Rights*, *supra* note 42; Reichman, *Electronic Information Tools*, *supra* note 5, at 830-35; Ricketson, *supra* note 7.

396. See CDPA, *supra* note 348, § 9(3). See also *id.* §§ 12(3) (duration of 50 years), 79(2), 81(2) (exclusion of moral rights); 214(2) (computer-generated design).

397. CDPA, *supra* note 348, § 9(3). See also CDPA, *supra*, §§ 214(2) (designating the "designer" of a computer-generated design to be "the person by whom the arrangements necessary for the creation of the design are undertaken"), 215(1) (making the "designer" the first owner when the design is not created on commission or in the course of employment).

398. See CORNISH, *supra* note 57, at 355. The hard problems currently arise when there is some interaction between a human author and a machine, but the statutory solution does not apply to such cases.

applied to certain technologies emerging in the field of artificial intelligence, it could produce questionable results precisely because the value-adding contributions of these systems will increasingly depend on users and not on those who generically arranged for the creation of any given set of outputs.³⁹⁹ For this and other reasons, the new law in the United Kingdom represents an interesting but unsatisfactory first attempt to deal with complex proprietary disputes looming just ahead.

It should not be thought that the kind of proprietary entanglements surveyed in this study are confined to computer program-related innovation, even though this sector graphically exhibits the most disturbing aspects of present trends. From a worldwide perspective, most new technologies entering the intellectual property system will increasingly attract an array of overlapping protective regimes that sometimes apply to different facets of the same or closely related subject matters.⁴⁰⁰ The more that these overlapping legal subcultures compete with each other, the harder it becomes to disentangle their separate protective strands, and the greater the pressure exerted on the prototypical legal regimes to modify their historical functions.⁴⁰¹ Meanwhile, the unique, unpatented know-how developed by innovators working in the new technologies is nowhere adequately protected as such. By the same token, no tailor-made authorship and ownership rules can be devised to implement a coherent set of policy goals because the policy goals actually being implemented pertain to a concatenation of semi-obsolete or often irrelevant forms of protection that were devised for different social and economic conditions.

399. See, e.g., GROVES, *supra* note 346, at 40; Reichman, *Electronic Information Tools*, *supra* note 5, 830-35.

400. See *Programs as Know-How*, *supra* note 3, at 662-67 (surveying the "patchwork quilt" of makeshift protective devices that include patent protection of genetically engineered organisms; copyright and patent protection of computer programs; *sui generis* protection of computer programs and of databases; copyright protection of databases; utility model laws; law protecting integrated circuit designs; laws protecting functional designs; ornamental design laws; and special antipiracy laws protecting new technologies against unfair competition). See also *supra* notes 58-59 and accompanying text (discussing the drive for copyright protection of biogenetic engineering products and possible overlap between patent law and plant variety protection laws).

401. Current efforts to cram new technologies into a system devised to protect "art" and "inventions" have strained the classical copyright and patent paradigms to the breaking point. As a result, copyright laws risk degenerating into mere unfair competition regimes at the expense of true authors and artists. See, e.g., Adolf Dietz, *Entwickelt sich das Urheberrecht zu einem gewerblichen Schutzrecht?*, in *WIRTSCHAFTSRECHT IN THEORIE UND PRAXIS* (W. Barfuss et al., eds. 1986); Corbet, *supra* note 27, at 68. By the same token, patent systems can degenerate into glorified "petty patents" regimes or mere registration systems at the expense of a competitive market place. See Reichman, *Legal Hybrids*, *supra* note 3.

The present study, like its forerunners,⁴⁰² thus tends to confirm that disarray results from concurrent application of diverse intellectual property laws to subject matter for which they were not devised. On the one hand, trivial or static components of new technologies increasingly receive exorbitant protection from various makeshift legal refuges while the innovators' most dynamic and valuable contributions remain difficult or impossible to defend against the subtler forms of free-riding. On the other hand, the different strands of proprietary rights spreading out from overlapping protective regimes weave a tentacular net for the unwary and add to the already high transaction costs with which the legal system saddles innovators.⁴⁰³ Viewed collectively, this patchwork quilt of protective devices reveals the extent to which applied scientific know-how, inadequately served by the traditional patent law matrix, now poses a serious threat to the stability of an international system built around a static notion of "industrial property" that no longer corresponds to empirical reality.⁴⁰⁴

Although a fuller discussion of these matters is best left to a future publication, it has become clear that the core of the problem resides in the difficulties of protecting applied scientific know-how once it becomes embodied in products distributed on the open market. To the extent that *each such product bears intangible know-how on its face*, third parties can reduce the innovator's lead time to virtually zero by duplicating the tangible product without incurring the costs of research and development from which it arose.⁴⁰⁵ The long-term solution, stated in its simplest terms, is to devise a new intellectual property paradigm that provides

402. See *supra* notes 3, 5, 40, 42.

403. See, e.g., Lewis M. Branscomb, *Preface* to INTELLECTUAL PROPERTY ISSUES IN SOFTWARE, *supra* note 48, at ix (suggesting that the legal process itself has begun to slow the pace of innovation and that it has especially harmed the small- and medium-sized firms that are its major exponents).

404. See *Programs as Know-How*, *supra* note 3, at 656-67. See also Reichman, *Designs and New Technologies*, *supra* note 40, at 136-44.

405. See *Programs as Know-How*, *supra* note 3, at 641-42, 648-67, 714-18. When the aggrieved manufacturer turns to classical intellectual property law for relief, he finds that applied scientific know-how fits imperfectly within the existing legal models. Incremental innovation is technically obvious and, therefore, virtually unpatentable by definition. See, e.g., 35 U.S.C. § 103 (1988); *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966). For copyright purposes, writings that embody technological innovation are assimilated to the subcategories of "factual" and "functional" literary works, which traditionally obtain only thin protection of expressive features against piratical duplication. See, e.g., *Feist Publications v. Rural Tel. Servs.*, 111 S.Ct. 1282 (1991); *Baker v. Selden*, 101 U.S. 99 (1879); Reichman, *Electronic Information Tools*, *supra* note 5, 801-06. But see Ginsburg, *supra* note 45. The use of unfair competition law to prohibit product simulation without evidence of consumer confusion violates cardinal tenets of the nineteenth century competitive ethos. See, e.g., *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141 (1989). Whether these nineteenth century principles yield satisfactory results when applied to twentieth century technologies is open to question. See Gordon, *supra* note 6.

incremental innovation bearing know-how on its face with artificial lead-time in which investors can recoup their investment and turn a profit. A law to protect applied know-how, regardless of the medium of expression, would then deter free-riders without unduly impeding fair-followers from developing incremental innovation of their own.

Future publications will explore the conceptual underpinnings of a proper know-how law and the means of implementing it without the market distortions characteristic of existing intellectual property regimes.⁴⁰⁶ Meanwhile, those who fear the foreseeable complications of a *sui generis* approach to applied scientific know-how should ponder the fate of existing intellectual property regimes that are put to abusive and inconsistent applications. Looking around the world, one is struck by the extent to which the laws applicable to patents, copyrights, trade secrets, unfair competition, trademarks and industrial design are increasingly destabilized by the need to deal with aspects of new technologies for which they are inherently unsuited. In short, rather than facing up to the new problems that might arise from a *sui generis* regime to protect applied scientific know-how, the intellectual property community is currently experiencing the simultaneous evolution of six or more poorly designed *sui generis* laws, as each traditional regime mutates in unexpected ways under the pressure of events. Sooner or later, unless the urge to throw stop-gap legal measures at a moving target is resisted in the interest of a more rational and constructive approach, a discredited intellectual property system risks collapsing of its own protectionist weight.

406. See Reichman, *Legal Hybrids*, *supra* note 3.

